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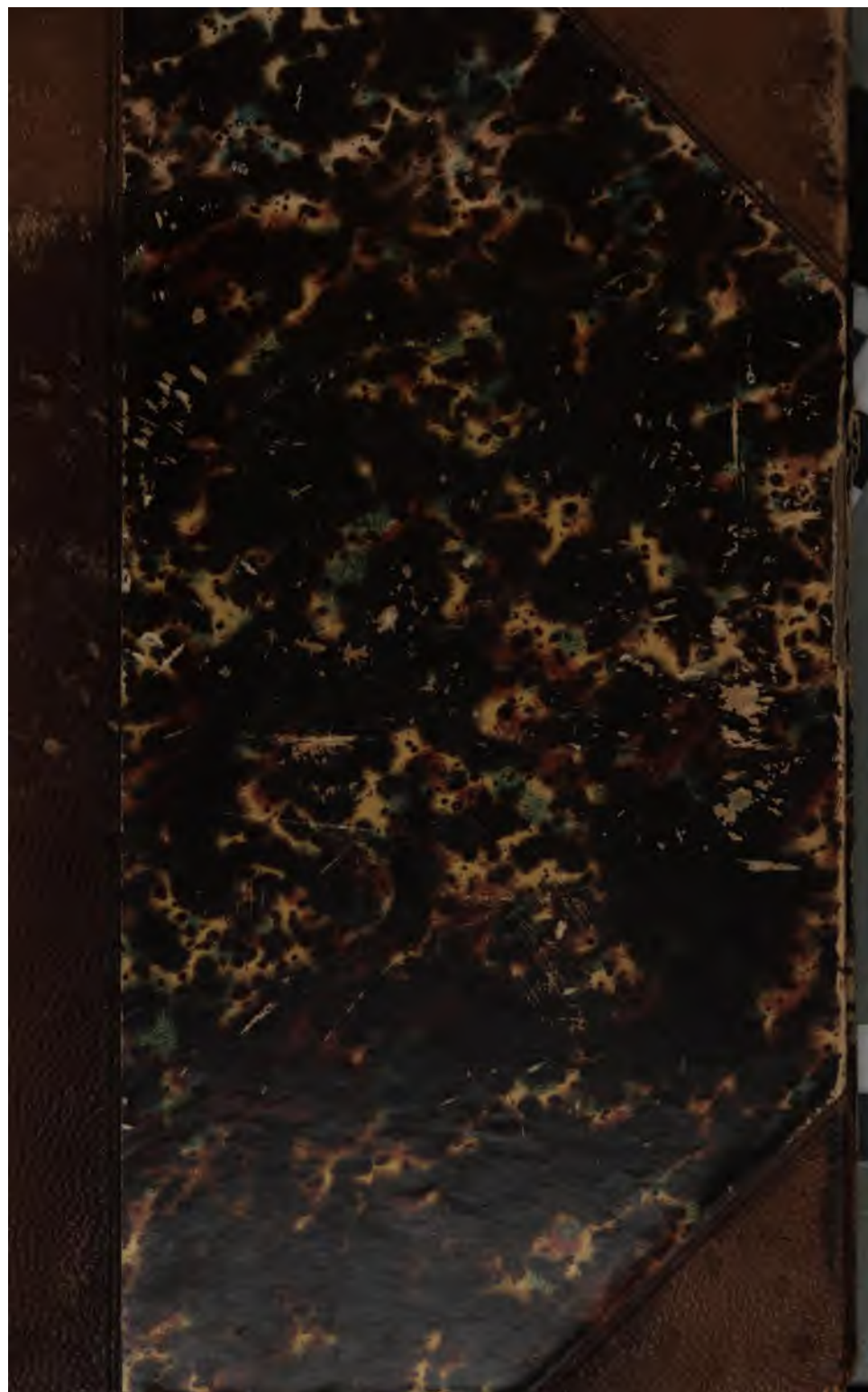
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*In Robert Sutton Esq*

THE  
*as a mark of respect from*  
AMERICAN  
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MINERALOGICAL JOURNAL: 31

BEING A COLLECTION

OF FACTS AND OBSERVATIONS

TENDING TO ELUCIDATE THE MINERALOGY AND GEOLOGY  
OF THE UNITED STATES OF AMERICA.

TOGETHER WITH

OTHER INFORMATION RELATING TO MINERALOGY, GEOLOGY  
AND CHEMISTRY, DERIVED FROM SCIENTIFIC SOURCES.

CONDUCTED BY

ARCHIBALD BRUCE, M. D.

PROFESSOR OF MATERIA MEDICA AND MINERALOGY IN THE MEDICAL INSTITUTION  
OF THE STATE OF NEW-YORK AND QUEEN'S COLLEGE, (N. Y.) MEMBER OF THE  
AMERICAN PHILOSOPHICAL AND LINNEAN SOCIETIES OF PHILADELPHIA, HO-  
NORARY MEMBER OF THE CONNECTICUT ACADEMY OF ARTS AND SCI-  
ENCES, MEMBER OF THE ROYAL MEDICAL AND WENERIAN SOCI-  
ETIES OF EDINBURGH, AND MINERALOGICAL SOCIETY OF JENA.

VOLUME I.

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District of New-York, ss.

**BE IT REMEMBERED** that on the twenty-third day of February, in the thirty-eighth year of the Independence of the United States of America, ARCHIBALD BRUCE of the said District, hath deposited in this office the title of a book, the right whereof he claims as proprietor in the words and figures following, to wit:

*"The American Mineralogical Journal: being a Collection of Facts and Observations, tending to elucidate the Mineralogy and Geology of the United States of America. Together with other information relative to Mineralogy, Geology and Chemistry, derived from scientific sources.—Conducted by Archibald Bruce, M. D. Professor of Materia Medica and Mineralogy in the Medical Institution of the State of New-York and Queen's College, (N. Y.) member of the American Philosophical and Linnean Societies of Philadelphia, Honorary member of the Connecticut academy of Arts and Sciences, member of the Royal Medical and Wernerian Societies of Edinburgh, and Mineralogical Society of Jena. Vol. I."*

IN CONFORMITY to the Act of the Congress of the United States, entitled, "An Act for the encouragement of Learning, by securing the Copies of Maps, Charts, and Books, to the Authors and Proprietors of such Copies, during the time therein mentioned;" and also to an Act, entitled, "An Act supplementary to an Act, entitled, An Act for the encouragement of Learning, by securing the Copies of Maps, Charts, and Books, to the Authors and Proprietors of such Copies, during the times therein mentioned, and extending the benefits thereof to the Arts of Designing, Engraving, and Etching Historical and other Prints."

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Clerk of the District of New-York.

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**T**HE object of this work is to collect and record such information as may serve to elucidate the Mineralogy of the United States, than which there is no part of the habitable globe which presents to the mineralogist a richer or more extensive field for investigation.

Of the utility of a publication of this kind, much might be said: it may however be sufficient to observe, that nothing has contributed more to increase and diffuse Mineralogical information than the periodical works on the continent of Europe, particularly those in Germany and France. At the present period, when such laudable exertions are making to improve and extend the manufactures of our own country, a knowledge of the mineral productions, on which so many of the useful arts depend, and with which nature has so liberally supplied us, becomes particularly desirable.

In order therefore that the design may be carried into effect, communications from those gentlemen who may have directed their attention to this interesting branch of science, are respectfully solicited, particularly such as may relate to the Geology and Mineralogy of particular districts; the history of Mines, their products, methods of reduction, and improvements in Metallurgy generally; descriptions of individual specimens, their constituent principles, localities and uses to which they may be applied; mineral waters, their situation, analysis and use in the arts, and in the cure of diseases, &c. A part of the work will be appropriated to such information as may be derived from foreign and domestic Journals.



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# THE AMERICAN MINERALOGICAL JOURNAL.

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JANUARY, 1810.

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*I. Descriptive Catalogue accompanying a suite of Mineral specimens presented to the Editor by his colleague, S. L. MITCHILL, M. D. Professor of Natural History and Botany, in the University of the State of New-York.*

THESE pieces were collected during a tour made, in the summer of 1809, to Niagara. They may serve to illustrate the mineralogy as well as the geology of that region, and of some places along the Mohawk river.

1. Brittle slate, or fragile shistus, which forms the inferior strata at the great cataract. The layers of this are full of cracks and flaws; and at the denuded edge, the fragments may be picked out by the fingers. They constitute part of the ruinous mass at the foot of the precipice below, through which the visitor to the falls must travel. This shistus decaying and crumbling, undermines the superior strata of the lime-stone, causing them to tumble down and enlarge the chasm into which the river pours.

2. Calcareous carbonate, or lime-stone, which forms the upper layers of rocks at the falls. It overlays the shistus

(No. 1,) and is supported by it. It is of the species called swine-stone, or *lapis suillis*, as appears from the strong and unpleasant odour it emits when rubbed or broken. In the neighbourhood the inhabitants burn it to quick-lime. It affords a good cement, and generally makes very white walls. Its disposition is tabular, and its strata extensive and horizontal. Their termination is abrupt and steep. Over and down these precipices, the water descends at the rapids, and finally plunges at the grand cataract.

3. A fine specimen of the calcareous rock, which predominates at Niagara, covered on one side by rhomboidal crystals. They are of a clear white; and are probably carbonates, as they emit bubbles when exposed to the action of a stronger acid. Their angles are all oblique.

4. Another sample of *rhomboidal crystallizations*. But on this, as well as on the preceding No. 3, there is an appearance of semi-transparent crystals, which manifest a greater tendency to assume the rectangular figure, and to form cubes. These might at first glimpse be taken for fluates of lime. In confirmation of your opinion that they contained no fluoric acid, I can now assure you that I made repeated experiments on some of the fairest of these crystals, assisted by Mr. Griscom, without finding any thing that would corrode glass. Though we pulverized this peculiar substance in a mortar of porphyry, and carefully added sulphuric acid in a proper temperature, we could not satisfy ourselves that the smallest erosion was produced on the surface of a window-pane duly prepared with wax.

5. Calcareous rock, carrying crystals resembling dogstooth spar.

6. A piece of the calcareous rock charged with iron pyrites. This piece is very valuable, as it contains that link in the chain of evidence which demonstrates the conversion of common lime-stone to gypsum hereabout; or in other words, the change of the calcareous carbonate to a sulphate.

7. Masses of white amorphous gypsum, picked up among the rocks beneath the falls. They are opaque, and seem to be produced in small pieces only; as the pyrites undergo partial decomposition here and there among the strata. In some places sulphureous oozings and discolorations may be seen near the bottom.

8. Gypsum and lime-stone in their natural connection. The appearance is exactly as I found it at the foot of the great cataract. The mode of connection between the carbonate and sulphate, contiguous without mixture, is worthy of notice. These and the preceding (No. 7,) are the substances vulgarly and erroneously denominated "the petrified froth of the falls."

9. Lamellar or plated gypsum of an almost transparent quality, found at the foundation of the rocks, below the precipice of the great fall.

10. Silicious earth of the quartz kind, connected side by side with calcareous carbonate, or the swine-stone of the region. On this are seen small crystals that scratch glass, and vestiges of the semi-transparent crystallization of No. 3 and 4.

11. White amorphous flint, with lime-stone.

12. Crystals of quartz broken from a silicious incrustation of a calcareous rock.

13. Black flint, or gun flint—such as abounds at Black-rock and in the Seneca prairies, imbedded in lime-stone, but not incorporated with it. This forms distinct lumps or parcels, and is employed for musquets.

14. Lime-stone with petrifications. They appear to be corallines and madrepores—from the neighbourhood of Fort Erie, above the falls.

15. Native brimstone from the Clifton-springs, eleven miles northwest of Geneva. Waggon loads of it lie on the surface of the ground. It seems to be a deposition from a water that rises very transparent, but emits a strong sulphureous odour.

16. Moss incrustated with sulphur. The water of these copious springs lets fall the brimstone freely on every thing it touches. But plants are not at all injured by it. They appear to vegetate perfectly well, and without sustaining the smallest inconvenience. Various animals live in it. Horses and cattle drink it freely like common water.

17. Lime-stone and sulphur, and calcareous sulphuret, as deposited at the Clifton springs.

18. Lime-stone from the stream of spring water, where it ran briskly, with its deposit of calcareous and sulphureous matter.

19. Marine exuviae consolidated in lime-stone, from the bottom of the sulphureous stream. The surface of this remarkable specimen is covered by brimstone deposited from the water.

20. The marine production, commonly called "petrified wasp's nest," or "honey-comb." I have a sample of this impregnated with pyrites, and penetrated by the petroleum called *Seneka, or Genessee oil*.

21. A piece of the dark striated quartzzy rock, forming silicious strata at the little falls of the Mohawk river, where the locks have been established by the western inland navigation company. At this place there was, in all probability, a natural dam in ancient days, which raised the water high enough to inundate the German Flats, and the low lands extending toward Utica. Besides the obvious and plain appearances of things, the water-worn holes in those unusually compact strata of silicious rocks, forty or fifty feet above the present level of the river, would seem to be conclusive proof of the great height to which the water of the Mohawk in former times, attained.

22. Sample of the silicious rock from the town of Amsterdam, on the Mohawk river. Nodules with quartz and schœrl, quartz and garnet, and other granitical compounds, are frequent hereabout and lower down toward Schenectady.

23. Quartz and garnet, and perhaps quartz and amethyst, from the Nose, a projecting mountain in Johnstown, north of the Mohawk.

24. An uncommon association of amianthus, graphite and quartz, from the neighbourhood of Ballstown springs.

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II. *Observations on the FRANCONIA IRON WORKS by*  
*Colonel GIBBS.*

FRANCONIA lies eight miles East from Connecticut River, in New-Hampshire. The country is mountainous, being part of the chain of the White Mountains. The Iron Works here have been constructed within two years, by a company of gentlemen, chiefly of Salem. The capital employed is said to be about \$ 100,000 dollars. There is at present one furnace, four forges, and two work-shops. The furnace is of that kind called Quarter Furnace. The blast is from two cylinder bellows, and in the forges the same improvement is about being adopted. There is manufactured here, bar iron, hollow ware, and a great variety of articles for the consumption of the country. As this town lies so remote from the sea coast, being 130 miles from Boston, there is a great and increasing demand for iron, and the proprietors will without doubt find it their interest to increase their establishment. On account of the vicinity of the mountains, charcoal may be purchased very low; the company own about 5,000 acres of land in the neighbourhood, which will afford them a sure and inexhaustible supply.

The ore is procured from a bed about four miles distant. The bed traverses a hill and is worked *au jour*. It is from five to eight feet thick in a Gneiss which alternates with Granite and primitive Greenstone. The direction is N. N. E. and S. S. W. like all the primitive Strata of New-England; the inclination perpendicular. This bed has been traced some dis-

tance, and promises to afford an abundant supply. Another has been found near it, but not so promising.—The mineral is the magnetic iron ore (*fer oligiste* of Hauy.) It is found compact, and fine grained.—The colour is a bluish grey, the powder nearly black; this ore is similar to the Swedish, and the same species which furnishes Europe and America with their best iron. In the same bed is found an abundance of crystallized and amorphous Red Garnet, Epidote of a light yellow colour, and Amphibole. The crystals of the Epidote are acicular, and interwoven confusedly.—In the neighbourhood is found a greyish granular limestone, which serves at the furnace as a flux; the Garnet found with the ore might be used for the same purpose.—This like other magnetic ores is refractory in the fire; but it probably would be less so if the modern improvements in furnaces were attended to.

The quarter furnace so called, used in this country, is generally about twenty-six feet high, and little attention is paid, notwithstanding its importance, to the form of the interior. The furnaces in Europe are from forty to forty-five feet high, and the internal proportions generally constant. In the more fusible and in the purer ores, such as the hematites and the spathose iron, the quarter furnace is less objectionable; but the operation of heat should be more gradual on the refractory and the impure ores. This is the effect of the high furnace, as it takes one-third more time for the ore to descend to the blast. It is then less necessary to roast the ore, and the remnant of sulphur is disengaged more freely, and other foreign substances evaporated or scorified. As the diameter is also proportionally increased, less heat is lost, and the produce of the high furnace will be greater.

There is another improvement which might be adopted, with advantage, in this country; it is that of leaving only one opening, and drawing off the scories and the metal together. It is thus managed.—A bed is made of powdered charcoal well beat down and surrounded by a border of the same; this receives the liquid metal about an inch deep. As the

scories are lighter, they soon rise to the surface ; a workman sprinkles them lightly with water, which hardens them, and they are drawn aside by hooks.—The iron when hardened is easily broken and carried off. By this method a great proportion of the iron contained in the scories (which is sometimes considerable enough to be melted a second time) is saved.

The castings at this furnace are, from lightness, neatness and strength, equal if not superior to any imported.—The steel furnace was just prepared.—The bar iron is of good quality in general, but some of it I am told is red short. This defect it is supposed arises from some other metal of different fusibility alloying the iron, so that when the bar has the red heat, the foreign metal being more or less affected than iron, separates, and the continuity of parts is destroyed. The remedy for this is simply to work the iron at a white heat, and also at one lower than the red heat. This species of iron so forged has then a greater tenacity than any other iron. The metal which forms the alloy is by some considered to be arsenic and by others copper, but I am led to believe that in this case it is titanium.

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### III. *Description and Analysis of an Ore of Lead from Louisiana.* By W. MEADE, M. D.

HAVING been favoured with a good specimen of lead ore from the mines at St. Genevieve on the Mississippi, and being desirous of ascertaining its constituent parts and productive quality, I submitted it to a careful analysis in the moist way as the most accurate, according to the example of Klaproth.

It is to be regretted that the country which affords this abundant and productive ore, has not as yet been described by any Mineralogist.

I know at present of no such description, and am unable therefore to enter into any explanation which could be relied on, having received my information from those who were perfectly ignorant of the subject. I shall therefore confine myself to a mere description of the specimen which I have obtained, and to an analysis of it.

Its mineral characters are as follows.

In colour and lustre it resembles metallic lead.

Its brilliancy is greater than the generality of ores of Galena.

Its structure is laminated and compact.

It is very brittle and easily divisible into fragments which generally assume the cubic form.

Specific gravity, 7.50.

I am also in possession of several specimens crystallized in a very curious and interesting manner. These specimens consist of groups of cubic crystals, from the most minute that is possible, to the size of one fourth of an inch, confusedly placed on each other, all of them are perfectly defined, exhibiting the planes of the four sides in a very distinct manner; and the structure of the large crystals, it is evident from the appearance of the surface of the plane, arises from an aggregation of smaller ones of the same form.

The specimens which I have seen are frequently intersected by small veins of calcareous spar, and to many of them are attached particles of white fine grained primitive lime-stone. I have also seen specimens of sulphate of barytes from the same place, of a tabular form, perfectly white and bevelled at the edges, containing imbedded in them cubic crystals of galena.

These circumstances show what the matrix of the ore is, and that it is not found in loose masses imbedded in clay, as has been repeatedly told me, but that it occurs in the usual manner imbedded in solid strata, or occasionally in detached masses, but always accompanied with carbonate of lime or sulphate of barytes as its matrix.

One hundred grains of the most compact variety of this ore finely pulverized was digested with six times its weight of nitric acid, of specific gravity 1.3 diluted with two parts of water ; when all action seemed to have ceased, I poured off the solution and repeated the process three different times, successively keeping up for several hours a very moderate heat with a lamp. During the digestion a light flocculent powder appeared on the surface which in a short time subsided to the bottom of the flask.

Having collected these solutions and weighed the precipitate when perfectly dry, it was found to contain twenty-eight grains, which when thrown on ignited charcoal burned away with a sulphureous vapour, leaving only a residuum of four grains which consisted of silex and oxyd of iron.

Into the solution obtained from the nitric acid I gradually poured a small quantity of muriatic acid ; a copious white precipitate immediately appeared, which soon subsided to the bottom ; continuing to drop in muriatic acid till no farther cloudiness took place ; I let it rest till the fluid was perfectly clear, a quantity of crystals of a white colour was found at the bottom of the flask, which of course were either muriate of silver or muriate of lead, or both. The clear solution was afterwards poured off, and the precipitate carefully washed with alcohol, and dried, when it was found to weigh 96 grains. In order to separate the lead from the silver, if any was present, I boiled it in a sufficient quantity of distilled water which has no action on muriate of silver, but in a certain proportion of which, muriate of lead is completely soluble. The whole of the precipitate was in a short time taken up, except so minute a portion of it, that it was impossible to collect and weigh it with any precision. It therefore appears that this ore contains but a very minute proportion of silver, and that calculating as has been ascertained, that 100 parts of muriate of lead contain 75 of metallic lead, this ore according to this experiment contains 72 per cent. of that metal.

To ascertain whether the ore contained any copper, I poured a few drops of Ammonia on the nitric solution after the precipitation of the lead by the marine acid, but no change of colour took place, which would have been the case had the most minute quantity been present.

To determine whether the solution contained iron, I poured on it a small quantity of prussiate of potash, which immediately changed the solution to a blue colour, exhibiting the traces of iron, but in such small quantity that no precipitate could be obtained from it.

Thus it appears that the constituent parts of this ore are nearly as follows.

Lead.	72
Sulphur.	24
Silex and Oxyd of Iron.	4
A trace of Silver.	

---

100

In the quantity of lead in particular, I conceive that I am tolerably accurate, as my attention was chiefly drawn to ascertain the proportion of that metal which it contained.

It may not be superfluous to observe here, that the general opinion which prevails, that these ores of galena which exhibit the greatest metallic brilliancy and lustre are the richest in silver, is in general erroneous, as appears from the result of the above analysis, and which I hope to have an opportunity of shewing more fully, in a comparison between this ore and another of a very different appearance which I am at present engaged in examining.

Jameson adds to this observation, another, which I have also found equally correct; such as, that those ores of galena which are found imbedded, or in large masses, are never so rich in silver as those which lie compressed in veins of solid strata. Those facts I hope to have the pleasure of more fully illustrating in a second communication to your highly valuable Journal.

IV. *A Geological account of Dutchess county in New-York,*  
by DR. SAMUEL AKERLY, in a letter to the Editor.

DEAR SIR,

**M**Y visit to Dutchess County during the month of August last, offered me subjects of reflection which may be worthy of a place in your Mineralogical journal, for which purpose I now present the observations thence resulting for your acceptance.

Dutchess County lies between West-Chester on the south and Columbia-County on the north, having the Hudson river on the west and Connecticut on the east. It has an extent of about 60 miles in length from north to south, and about 24 in breadth. This county had a population exceeding 60,000 at the last census taken in 1801.

The introduction of Gypsum of late years has greatly improved the agriculture in this and the neighbouring counties. The hills in Dutchess County, though numerous, are capable of cultivation to their very tops, excepting the highlands and a few that are more abrupt than the generality of them, being all however well adapted to the raising of merino sheep which have already made a rapid increase. Bread and Indian corn may be considered the staple commodities of this county.

Not being sufficiently acquainted with the county to form a statistical account of it, I return from this digression to give a geological view of it; for this purpose it may be considered under the heads of Granite, Slate and Lime-stone.

### GRANITE.

That part of the highlands on the east side of the Hudson, is included in the south part of the county. These mountains consist of masses of granite, containing most of the materials that enter into the composition or aggregation of this primitive rock, under the distinctive appellations of gneiss, shistose mica, granatine, granitelle, shorl, trap, hornblend,

&c. The region occupied by these mountains covers a space of about 300 square miles. Very few of them exceed a thousand feet in elevation above the surface of the Hudson river. Antony's nose, as measured by the British during our struggle for Independence, is laid down on a map made under the directions of Lord Howe in 1777, to illustrate his proceedings against the colonies, at 1128 feet. The mountains of the highlands abound in ores, Iron however being the principal one that has yet been extracted and worked to advantage. That other valuable ores may be found in these elevated ridges, I have no doubt, and I have been assured by a person who had followed mining in Europe, that he had in this county, met with the ore of tin and some others of which he was uncertain as to their nature, at the same time remarking, that he was surprised at the facility with which metals in this country may be obtained, as the indications were so very evident, the metals themselves frequently appearing on the surface of the earth.

Few other hills in this county, are granitic besides the highlands. In the town of north-east in the upper part of the county, there is one nearly a thousand feet elevated above the surrounding country, consisting of grey granite. It may be remarked of this mountain, as I have before, respecting the Shawangunk mountains in Ulster and Orange Counties in my letter to Dr. Mitchill (*Med. Repos. Hex. 2. vol. 3. p. 324*) that the eastern declivities are steep and abrupt, while the western descend on an inclined plane forming a small angle with the horizon. Beneath the eastern declivity, down which I descended with difficulty, lies a small lake the head waters of Wappingers creek, which empties into the Hudson between Poughkeepsie and Fishkill. The water of this lake is very clear and transparent to a considerable depth, containing a number of fish and the water lily, (*Nymphaea advena* of Aiton) in abundance where the water is not too deep for its growth. While fishing in the lake, my attention was drawn to the great discharge of air, from the

bottom which was of a very loose texture and softer than mud, being a body of turf grass, (*Sphagnum palustre*). On returning to the lake with proper apparatus and a light, the air was found to be very pure inflammable air, taking fire instantly and producing a considerable ascending flash. Intermittent fevers do not prevail around this lake. Thunder storms are very severe at times in this neighbourhood, frequently destroying barns and houses. It has been observed in this part of the country that electrical flashes descending from the clouds have been met by streams ascending from the earth, similar to the production of water spouts as observed by Dr. Franklin. Tesink mountain is underlaid with primitive slate, while the highlands have no apparent substratum other than granite.

I cannot here omit to mention the improvement in a quantity of waste or swampy land, along the outlet of this little lake, which by draining has been converted into fine hemp ground, where considerable quantities are now raised.

### SHISTUS OR SLATE.

The whole of this county north of the highlands is underlaid with primitive slate generally of a bluish colour but sometimes red, the rifts being filled with quartz. In the town of North-east I found slate and lime-stone so combined as to render it difficult to determine by the eye which to call it. The slate extends eastward into Connecticut. In many places it is seen taking a direction between S. W. and N. E. having an inclination to the eastward forming an angle of about 45°. A similar direction and disposition is observed in the granite of this island.

### LIME-STONE.

Great quantities of lime-stone are found in Dutchess County, most of the hills being composed of it. On the banks of the Hudson at Barnegat it is burnt into quick-lime. There

is a great deal of the lime-stone incapable of forming quick-lime, being combined with a great quantity of quartz. In some specimens I brought away, the quartz appears like small grains of sand imbedded in the lime. Some hills are of the fœtid kind of lime-stone called swine-stone. The well which supplied the house with water where I remained during my visit, was partly dug through a rock of this kind. Upon the application of tests to this water, it was found to contain lime and sulphuretted hydrogen. Neither the slate or lime-stone have as yet been found to contain any vegetable or animal impressions. We must hence infer that all the rocks in this county as far as have yet been observed, are of the primitive kind.

These primitive materials of our globe have never been much explored for metallic veins, though they have appeared very near the surface. A very rich iron ore has lately been found about eight miles north of Poughkeepsie. I visited the farm of Jacob Boukay in the town of Armenia, where ores of lead, copper, and zink have been found in a body of lime-stone in low ground on the side of a mountain. Lead appears to be most abundant, though no great quantity has yet been obtained, but search has been made to no great depth. It is frequently ploughed up in considerable masses. From the external appearance there is a probability that the ore may be found in sufficient plenty to render it an object worth making a search.

Besides these things a mineral spring was mentioned to me, but indisposition rendered it impossible for me to visit it. In walking over Isabella Landen's property at pine plains in the town of North-east, in a neglected corner of the farm, I found a spring which appeared to be a sulphuretted water. The following memoranda and experiments were made on the spot in the month of August.

• The spring being cleared of the mud which had choaked it for a number of years, was found to issue in a small stream from a calcareous gravelly soil, towards the west, at the

bottom of a hill, composed of limestone, and about five paces from its strata. It is known on the farm by the name of the stinking spring ; having a sulphureous smell, and thin pellicle on its surface, and depositing a black, muddy, sediment. Bubbles of air are frequently seen rising from the bottom, especially when disturbed by a stick.

The water is clear, having a slight acid and somewhat nauseous taste. After the spring was cleared, and the water again became transparent, the sulphureous smell was not so powerful, except when agitated. On drinking a pint in the morning, upon an empty stomach, it excited a slight burning sensation in the fauces, and proved laxative.

Upon adding a solution of nitrated silver to the spring water, its transparency was disturbed by light milky clouds, which became diffused, and the mixture gradually turned black ; forming a black precipitate, which settled at the bottom of the glass.

The muriate of barytes produced a heavy white opaque cloud, which immediately occupied the bottom of the glass, and nearly half the water in it ; remaining twelve hours without alteration, and leaving the upper portion of the water clear.

Oxalic acid in crystals, when dropped in the water, produced beautiful white streaks, arising to the surface, and rendering the whole fluid white, which in twenty-four hours deposited a white precipitate.

Lime-water produced a milky turbidness, till the quantity being equal to that of the spring-water, the mixture began to grow clear, and white flakes to settle, which in twenty-four hours formed a white precipitate. The sulphureous smell was immediately destroyed on adding the lime-water.

The air of the spring collected in a glass vessel, extinguished a burning candle.

Several fish caught in a neighbouring brook, when put into the spring, appeared to gasp for breath ; and frequently rose to the surface for air. The one most injured in catch-

ing, turned on his back in a few minutes, and was again taken out and revived in brook-water. When again put into the spring, it soon turned on its back; it was again revived, but with greater difficulty, and longer time, and died when returned to the spring. A second one lived six hours, but its vigour was impaired, and it could be taken with the hand at any time while living; when dead, its gills had lost all their redness. Another, and the largest, was alive twenty-four hours, and was thence missing.

Indisposition at the time, prevented further experiments on these waters, from which we are led to conclude the presence of carbonic acid gas, sulphuretted hydrogen, lime, and sulphuric acid.

The well, mentioned above, was on the hill beneath which the spring issued. In digging, to increase the supply of water, the calcareous rock was struck about five feet beneath the surface, but no increased flow was obtained.

*V. Chemical examination of HEAVY SPAR from New-Jersey, by MR. GEORGE CHILTON.*

ON a branch of the Delaware about four miles from the village of Newton in Sussex county, a stone was found, which was ground, by the farmers of that neighbourhood, and strewed on their lands, from an idea they entertained of its being a species of Gypsum. Their account of the experiment states that although it seemed to be of some service, it did not possess any remarkable fertilizing quality.

Hearing of this, I obtained a specimen, which from its appearance and great weight, I did not hesitate to pronounce Sulphate of Barytes. From this specimen I prepared the nitrate, muriate and Hydro-sulphuret of barytes, and extracted the pure earth.

Finding it of importance in the preparation of tests and

re-agents, I procured a considerable quantity of it, and at length visited the spot where it was found. It forms a vein in grey limestone extending from N. E. to N. W. and making an angle with the horizon of about  $40^{\circ}$ . From the place where the vein is opened to the distance of 200 yards, detached masses are found lying on the surface, which when broken up present a spheroidal nucleus of 5 or 6 inches diameter, around which the spar had confusedly aggregated. In some instances this nucleus was calcedony, in others quartz, grey lime-stone, &c.

The colour of this fossil is white, with various shades of yellow, and appears to be the lamellar species of heavy spar, having the foliated structure with a threefold cleavage, easily frangible, splitting into rhomboidal fragments.

The crystallized specimens, are in rectangular bevelled tables united into radial groups which cross each other at various angles of obliquity.

The specimen selected for examination was of the massive kind of a pure white; translucent with a pearly lustre. Spec. gr. 4.417. Before the blow-pipe, in small fragments it decrepitates, but the powder fuses, difficultly, without addition.

1. 200 grains reduced to a fine powder mixed with twice their weight of carbonate of potass and five of water were boiled to dryness in a silver basin. Water was added and the boiling to dryness repeated. Water was again added and the whole thrown on a filter. The residue dried in a heat of  $212^{\circ}$  weighed 176 grains. These were dissolved by muriatic acid, with effervescence, excepting  $33\frac{1}{2}$  grains.

2. These  $33\frac{1}{2}$  grains were mixed with thrice their weight of carbonate of potass, with water, and repeatedly boiled to dryness. After solution, filtration and drying, the residue weighed  $8\frac{1}{2}$  grains.

3. These  $8\frac{1}{2}$  grains were exposed with thrice their weight of carbonate of potass in a heat nearly red, for half an hour. After the addition of water, filtration &c. the residue weighed  $6\frac{1}{2}$  grains, after being digested in muriatic acid, an insoluble

part was left, which when dried in a red heat weighed  $5\frac{1}{4}$  grains, having the properties of silex.

4. The muriatic solutions evaporated to the point of crystallization, during which  $\frac{1}{4}$  grain of oxide of iron separated, shot into tabular crystals of muriate of barytes, but on the side of the evaporating vessel some needle-shaped crystals were formed which seemed to announce the presence of strontites. A few of these were washed in alcohol, which, on kindling, burnt with a carmine red coloured flame.

5. This circumstance, together with the yellowish tint, which the last formed crystals had, induced me to redissolve them. The solution treated with caustic ammonia let fall a light brown precipitate, weighing when dried  $\frac{1}{4}$  grain. It appeared to be a mixture of oxide of iron and alumine, for on adding a little dilute sulphuric acid, an aluminous taste was observable, and prussiate of potass separated a prussian blue precipitate.

6. The solution was now decomposed by carbonate of potass, and muriatic acid added to the precipitate. The solution was opalescent, and let fall a very trifling portion of, what I supposed to be alumine. On leaving the solution to spontaneous evaporation, nothing but tables of muriate of barytes appeared with the exception of a few acicular crystals.

7. Desirous of evaporating the small portion of strontites, with which the barytic salt seemed to be associated, the whole of the crystals were dissolved in warm water, and barytic water added, which immediately threw down a precipitate, so trifling in quantity however, that when dried, it could not be detached from the filter. The paper was steeped in alcohol and the latter set on fire. It burnt with a distinctly tri-coloured flame of Red, Yellow and Blue.

8. 100 grains of the powdered spar which were submitted to a red heat, sustained a loss of 2 grains.

9. One half of the alkaline solution which contained the sulphuric acid of the fossil was saturated with an acid and evaporated. Nothing separated but a very little silex.

With the other half, I intended by reproducing the sulphate to get in this direct way, the proportion in which it exists in the fossil, but by an accident a part of it was lost, and the muriate had been too freely used to afford an accurate determination. The following approximation however will be thought sufficiently near. The portions dissolved with effervescence in muriatic acid in the 1st 2nd and 3rd processes, may, without sensible error, be reckoned carbonate of barytes containing according to Klaproth 78 per cent. barytic earth. The sum of these parts is 157.30 which multiplied by .78 gives 122.69 the barytic earth contained in 200 grains. But in the sulphate the earth is to the acid nearly as 2 to 1 therefore 100 grains of the barytic spar contains

Barytes	61	34
Sulphuric Acid	30	67
Silex	3	
Oxide of Iron and alumine	1	
Water	2	
Strontites, a trace		
	98	01

#### VI. *Mineralogical notice respecting the WEST RIVER MOUNTAIN, Connecticut river—by COLONEL GIBBS.*

**T**HIS Mountain having been announced in the American Geography and in the annals of the American Academy, as volcanic, I had the curiosity to visit it. As the neighbourhood is granitic, and the mountain itself craggy, my expectations were not very sanguine.

On ascending it I found no trace of eruption, and no species of rock but the granite and gneiss. There had been however, a shaft sunk of about 40 feet, near the top, from whence hematite iron ore was taken many years ago, and some small pieces lay scattered about. As it was impossi-

ble to descend the pit, I could not ascertain the breadth of the vein.

From this hole, (as the inhabitants of the nearest house informed me) noises like thunder had been heard many years ago, and a flame had been seen near the spot. The first report probably arose from the wind rushing through a cleft of the mountain near the shaft; the last from a popular superstition through the country, that the presence of the precious metals is frequently indicated by a flame which arises from the ground at night. I found also that the neighbours believed in the existence of these metals in the mountain. It is probable therefore that some traveller less superstitious, but not less ignorant than these good people, took their stories and gave us an account of a volcano.

At the Museum at Hartford, I was shown "a piece of the real lava of the West Mountain," as a confirmation of the report. On examination, I found it to be the hematite ore above mentioned.

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#### VII. *Chemical examination of a MINERAL WATER from Litchfield, State of New-York—by Mr. JOHN GRISCOM.*

A FEW bottles of mineral water lately discovered in Litchfield, in the county of Herkimer, in this State, having been put into my hands for examination, the following experiments were made with it, the insertion of which in the Mineralogical Journal is submitted to the editor; though not without hesitation, as the want of leisure absolutely prevented me from applying to the examination that share of attention which would have been necessary to satisfy my own mind fully with respect to the contents of the water. What I have done may, however, serve to stimulate some other person, possessed of better opportunities, to undertake an analysis of this spring. While most of the noted

mineral waters of Europe have been examined with scrupulous accuracy, it is much to be regretted that so very few of those of the United States have claimed the attention of scientific men. I cannot but hope, from the very laudable design of this Journal, that its pages may become the vehicle by which the public will be made acquainted with the chemical constitution of a great number of our medicated waters.

To furnish a complete account of a mineral spring, it is necessary that the experimenter resort to the fountain; that he examine the geological structure of the adjacent country; determine the physical character of the spring; and operate with large quantities of the water. But until opportunities for this occur, it is desirable to have at least so much information as may be obtained from the application of re-agents to small quantities of the water. The spring at Litchfield, I was informed, has been resorted to with great effect for obstinate cutaneous diseases, as well as for others of a different nature.

The following local description is from a gentleman\* who has surveyed the country round the spring.

LITCHFIELD SPRINGS are so called from a township of that name in the south part of the county of Herkimer. They arise from the ground in a flat near the head waters of the Unadilla river, at the height of land between the waters running into the Mohawk and Susquehannah rivers.

The country around them is very fertile, and well inhabited. At about two feet below the surface of the flat around the spring, for some distance, is a bed of round stones of various kinds and sizes, most of which, however, are lime-stone. West of the springs is a Hill of the height, I should judge, of 70 feet—its base is lime-stone rock, through which I suppose the springs pass. The country generally abounds in lime-stone. There is a run of

\* R. V. Cooper, Esq.

this stone running from the North River (perhaps further,) through Schoharie, (where I am told there is a similar spring) Otsego, Chenango, Onondaga, Cayuga, Ontario and Genessee, to lakes Erie and Ontario. This vein is in some places narrow, and in others it spreads to a great distance. I have uniformly found that where this stone is prevalent the country is fertile. The springs are a few feet apart, and of an equal size: the water perfectly clear, but in passing over logs, sticks, &c. it leaves a white stringy substance adhering to them. The place is much resorted to by the neighbouring people for cutaneous complaints, and generally effects a speedy cure. They also mention many other disorders for which the waters have been useful. I can truly say that they give a man a fine appetite for his dinner.

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### EXAMINATION OF THE WATER.

WHEN a bottle which had been well sealed was first opened, the water was perfectly transparent, but on standing exposed to the atmosphere a few hours it became turbid. Its taste was sulphureous, and its smell slightly fœtid, somewhat resembling the washings of a gun-barrel.

EXPERIMENT I. *Infusion of litmus*, added to a portion of the water was not altered in colour. This test evinced the presence of a drop of sulphuric acid in a pint and an half of rain water. *Infusion of red cabbage* (an excellent and convenient test) was tried with like result.

II. *Paper which had been stained by the blue petals of the Iris, or common flag*, after being slightly reddened by very diluted muriatic acid, had its blue colour restored on immersion in the water. Litmus water reddened by distilled vinegar, was restored by the fresh water.

III. *Tincture of Turmeric*, was not changed either by the natural water or that which had been boiled.

IV. *Acetate of Lead*, (newly prepared) occasioned a white precipitate in the fresh and in the boiled water. But this test when added to the water which had become turbid by exposure, produced a dark chocolate coloured precipitate. Letters traced with transparent leadwater, became immediately legible on holding the paper over the bottle. A bright piece of silver was tarnished in fifteen minutes by submersion. A portion of quick-silver was in like manner covered with a greenish pellicle.

V. *Sulphuric acid* occasioned no effervescence.

VI. *Solution of muriate of mercury*, made no change in the fresh water : but on being added to the boiled water while hot, it produced a reddish white cloud.

VII. *Muriate of lime* had no sensible effect.

VII. *Tincture of galls* produced no change of colour. A piece of gall-nut suspended in the water during 10 days shewed no sign of blackness.

IX. *Prussiate of potash*. No effect. If a little sulphuric or muriatic acid be previously added to the water, the Prussian alkali develops a blue colour ; but this is owing to a decomposition of the test, which (unless prepared with extreme nicety) is a triple prussiate of potash and iron.

X. Eight ounces of the water after boiling fifteen minutes was filtered. The precipitate weighed three fourths of a grain, and was entirely dissolved in muriatic acid with effervescence.

XI. To the filtered boiled water *caustic ammonia* was added, which produced a white flocculent precipitate. The unboiled water gave the same appearance with this test.

XII. The solution (No. x.) gave no precipitate with ammonia, nor with the further addition of sulphuric acid. *Carbonate of potash* added to the ammoniated liquor, made it turbid. A portion of the same solution to which a little

alcohol was added, when treated with the same tests, shewed the same results.

XIII. To a portion of the water concentrated by evaporation, *nitrate of silver* was added, which produced a light brown or flesh colour.

XIV. With *nitrate of mercury* a copious yellowish precipitate was thrown down both from the boiled and unboiled waters; and this after *nitrate of barytes* had had its full effect.

XV. A solution of *muriate of barytes* immediately occasioned a copious precipitate, there having been previously added to the water a small portion of muriatic acid to counteract the effect of any carbonated earth that might exist in it. *Nitrate of barytes* caused a similar dense precipitate; when added to fresh water, or to that previously acidulated with nitric acid.

XVI. To portions of the water, both fresh and concentrated, which had been freed from sulphuric salts by *nitrate of barytes*, *nitrate of silver* was added. A slight turbidness ensued, which after remaining two hours exposed to the light, did not change its colour from a white.

XVII. To the concentrated water a solution of *pure potash* was added. A thick white cloud was instantly formed, and a light precipitate collected, which was immediately discharged by a few drops of either of the mineral acids. The same experiment was repeated with water boiling hot, with the same effects, excepting that when nitric acid was added to the alkaline precipitate the water assumed a dusky brown colour and a dirty powder was deposited.

XVIII. *Oxalic acid* produced after a short time a milky appearance.

XIX. *Oxalate of ammonia* caused an immediate precipitate in the concentrated water.

XX. *Alcohol*, added in equal portions to the boiled water, occasioned a crystalline deposit.

XXI. A quantity of the powder obtained by boiling the water to dryness, was dissolved in distilled water. The solution yielded a considerable deposit when treated with *muriate of barytes*, or with *oxalate of ammonia*.

XXII. To a portion of the water previously increased by a few drops of nitric acid, and boiled. *Caustic ammonia* was added, which gave a considerable precipitate. The supernatant water was drawn off by a syphon, and the precipitate was well washed, then re-dissolved in nitric acid, and again precipitated by carbonate of potash. This last precipitate being dried by a gentle heat, was exposed to the action of dilute sulphuric acid, but no perceptible portion of it was taken up.

### CONCLUSIONS.

From the smell of the water when first opened as well as from the results of experiment 4th, it is evidently impregnated with sulphuretted hydrogen or hepatic air.

Experiment 1st, proves that no free acid exists in the water, and it also serves to shew that the sulphuretted hydrogen is not contained in very large quantities as it is well known that this air, when abundant, will slightly redden vegetable blues. The effect shown in experiment 2d, may have been produced by the presence of carbonate of lime, an inference which we find supported by experiment 10th. That the proportion of this calcareous carbonate is, however, very small, appears from experiment 5th. No alkalis either free or ærated experiment 3d. The cloud produced by muriate of mercury, (experiment 6th) indicates the presence of hydrosulphuret of lime, the existence of which is also confirmed by experiment 13th and 14th.

Experiment 8th and 9th, prove that the water contains no iron unless in a quantity not easily appreciable.

The results of experiment 12th shew that the powder obtained by boiling the water 1-4 hour, consists chiefly, if not entirely, of carbonate of lime. Experiment 15th satisfactorily proves that the water contains sulphuric acid; and that it exists in combination is also evident from experiment 1st. It may be inferred from experiment 16th that the water is clear of muriatic salts. The effect mentioned may have arisen from hydrosulphuret of lime. The light precipitate formed in experiment 17th may have been occasioned by any of the earthy salts, formed by mineral acids. The effect shewn with the boiling water, may be attributed to the calcareous hepar. From experiment 22d we may conclude that the water contains no magnesia. The substance which last remained was probably alumine. Experiments 18th and 19th shew the existence of a large proportion of lime. These, together with the results of experiments 15th, 20th, and 21st, prove that the principal saline ingredient in this mineral spring is sulphate of lime or gypsum.

This substance, together with a considerable quantity of hydrosulphuret of lime, and a small portion of carbonate, may therefore be considered, so far as this trial has extended, as constituting the chief soluble matters in the Litchfield water, independently of its gaseous contents, a portion of which is sulphuretted hydrogen.

VIII. *On NATIVE MAGNESIA from New-Jersey. By the EDITOR.*

**A**LTHOUGH Magnesia enters into the composition of many mineral substances, yet its existence in the mineral kingdom, in an uncombined state, has, till within these few years past, been unknown.

Brogniart, in his Mineralogy, has described several minerals under the name of Magnesite, (a term he has introduced as expressive of the large quantity of magnesia they

contain) in some of which magnesia appears to exist in a pure state. Of those which approach nearest to native magnesia, are the magnesites of Piedmont, as described by Giobert in the *Journal des Mines*, particularly the variety from Castella Monte.\* Although this mineral, as analysed by Guyton de Morveau, afforded a large proportion of carbonic acid, yet it appears from the assertion of Giobert, that when first taken from the quarry it contains no carbonic acid, but that it absorbs it after being two or three weeks exposed to the atmosphere.

The magnesite from Baudisserof†, which is near Castella Monte, contains in the hundred parts, according to Giobert, 68 magnesia, 12 carbonic acid, 15 silex, 2 sulphate of lime, and 3 of water. This, like the magnesite from Castella Monte, he thinks obtains its carbonic acid from the atmosphere.

The magnesites from Vallecas in Spain, and Salinelle in France, contain no carbonic acid; they however all have a large proportion of silex: that of Salinelle, according to Vanquelin, contains 55 parts in the hundred.

Brochant mentions, as native magnesia, a substance found at Robschütz, in Moravia, by the late Doctor Mitchell, of Dublin, which, according to Dr. Mitchell's Analysis, and that of Professor Lampadius, contains nearly equal parts of magnesia and carbonic acid. Why this mineral is described as Native Magnesia, I am at a loss to determine; unless, like those of Giobert when first discovered, it contained no carbonic acid, but absorbed it after exposure to the atmosphere.

At Hoboken, in New-Jersey, on the estate of Mr. John Stevens, is found a mineral, which presents the following characters:

\* *Journal des Mines*, No. 119.

† *Journal des Mines*, No. 118.

Colour, white passing into greenish white.

Lustre, pearly.

Structure, foliated; the folia or leaves frequently having a radiated position.

The folia, when separate, transparent; in the mass, semitransparent; the surface, after exposure to the weather, becoming opaque.

Somewhat elastic.

Adheres slightly to the tongue.

Soft.

Powder, pure white.

Specific gravity 2, 13.

Before the blowpipe becomes opaque and friable, and loses weight.

Soluble in the sulphuric, nitric, and muriatic acids.

This mineral occurs in veins, from a few lines to two inches thick, traversing serpentine in every direction.

### ANALYTICAL EXPERIMENTS.

A. On some of the mineral, finely powdered, was poured diluted sulphuric acid; an immediate solution took place unattended with effervescence. The solution was transparent and colourless, and extremely bitter to the taste.

B. To a portion of the solution A, was added pure ammonia; the fluid remained clear for a few minutes, when it became turbid; and after standing several hours a white cloud occupied the lower half of the vessel; the supernatant fluid was transparent and colourless.

C. Into another portion of the solution was dropped crystals of oxalic acid. The crystals were dissolved, the fluid remaining clear.

D. A third portion of the solution was evaporated, until a pellicle formed on the surface; in a few hours well-defined crystals of sulphate of magnesia were formed; the remaining fluid being exposed to spontaneous evaporation,

until the whole had gradually disappeared, crystals of sulphate of magnesia alone remained.

E. Fifty grains of the mineral, finely powdered, were put into a vial, to the mouth of which was adapted a spiral glass tube, which, together with a vial containing diluted sulphuric acid, were accurately weighed. The diluted acid being poured into the vial containing the mineral, the tube was immediately inserted: the solution having taken place, and the whole again weighed, it was found that no loss of weight had been sustained.

F. One hundred grains of the mineral in powder, exposed in a platina crucible to a red heat for half an hour, lost thirty grains.

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From Experiment D, it may be inferred that magnesia forms the principal ingredient in this mineral. Had alumine been present, the ammonia in Experiment B would have caused an immediate copious white precipitate, consisting of the whole of the alumine, with a much larger portion of magnesia than if no alumine had been present. This appears to arise from the very powerful affinity which exists between magnesia and alumine; as, according to Chenevix,\* magnesia, when unaccompanied by any other earth, and dissolved in an acid, is only partially precipitated by ammonia, however in excess, the remaining liquor being a soluble ammoniaco magnesian salt.

The absence of lime is proved by Experiment C. Had any been present, the oxalic acid, from its superior affinity for that earth, would have united with it, and formed an oxalate of lime, which would have been precipitated in the form of a white powder.

Experiment E shews the absence of carbonic acid and other gaseous matters; consequently the loss of weight sustained in Experiment F must be attributed to the loss of

\* Annales de Chimie. tom. xxviii.

water. We therefore may conclude that this mineral contains in the hundred parts,

Magnesia	70
Water of Crystallisation	30
	<hr/>
	100

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IX. *Mineralogical Note respecting PHOSPHATED LIME, and PHOSPHATED LEAD, from Pennsylvania. Communicated to the Philadelphia Linnean Society by Mr. S. GODON.*

THIS substance is of a blueish green colour, sometimes varying to grey, rarely with a crystalline shape—some crystals appear, belonging to the varieties, *primitive* and *peridodecaedral* of Haüy.

It presents no sensible phosphorescence on burning coals. It does not melt before the blowpipe, by a continued heat the edges only become a little rounded.

It dissolves entirely in nitric acid, sometimes with the extrication of some bubbles; the solution forms an abundant precipitate with oxalate of ammonia. Lime-water added to the same solution, when in sufficient quantity to saturate the excess of acid, occasions a gelatinous precipitate, which is phosphate of lime.

These observations are sufficient to distinguish this substance from the Emerald, (Beril) which it frequently accompanies.

It is found in the eastern part of Germantown, about six miles from Philadelphia, and probably in many other places. In this spot it occurs imbedded in loose fragments of Felspathic rock, scattered on the ground, these fragments belonging evidently to Gneiss, which forms the predominant mass of the country.

I have also found Phosphated Lead in the veins of Pyritous copper at Perkiomen.

X. *Description of MELANITE, from Pennsylvania, and AMBER, from New-Jersey. By Mr. CHARLES I. WISTER.*

SIR,

I WISH to communicate through the medium of your Journal a short account of two minerals, which I have in my collection, whose occurrence in this country is not generally known.

MELANITE.

In the district of Germantown, six miles north-west of Philadelphia, this mineral is found in Gneiss reposing upon Granite, of which the feldspar is snow white, and has a high degree of transparency. It occurs in crystals of a velvet black colour of considerable lustre, varying from the size of a pin-head to one inch in diameter. The crystals are polyhedrons, with twenty-four trapezoidal faces ; specific gravity 3.616. Through the Granite of Germantown crystals of Tourmaline, Mica, Phosphate of Lime and Beril, are universally disseminated, but I have never met with Melanite except in one particular place.

AMBER.

This mineral occurs in New-Jersey about four miles from Trenton, on Crosswick's creek, in the second kind of alluvial deposit. It occurs in grains varying from an eighth to an inch in size, reposing upon wood-coal, and passing through it in an opposite direction to the ligneous folia. It also occurs based upon hepatic pyrites, in a state of decomposition. I have in my collection well-defined specimens both of the yellow and white variety.

**XI. Mineralogical Notice respecting AMERICAN FLUATES OF LIME. By the EDITOR**

**T**HE fluat of lime is as yet a rare mineral in this country. The following description and locality of several varieties prove, that though not yet noticed, this substance exists in many parts of the United States.

*1. Fluat of Lime from New-Jersey.*

Colour light passing into deep purple.

Fracture lamellated.

When cleaved, presents a tetrahedral or octaedral form.

Semitransparent.

Cuts carbonate and sulphate of lime ; easily scratched by quartz.

Phosphorescent when thrown on ignited coal.

Before the blowpipe it melts into a white enamel.

When powdered and exposed to the action of sulphuric acid on glass, is dissolved with slight effervescence, the glass becomes corroded.

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Occurs disseminated in lamellated carbonate of lime, with crystallised mica and carburet of iron, near Franklin Furnace, Sussex county, New-Jersey.

This variety of fluat of lime is likewise found imbedded in a rock composed of greyish quartz and whitish felspar, which forms a vein several feet thick, running N. E. and S. W. breaking out two miles from Hamburg, Sussex county, on the Turnpike road to Pompton.

*2. Fluat of Lime from Connecticut.*

Colour, light and dark purple, violet, light green passing

into dark green, light and dark yellow.

Transparent and semitransparent.

Occurs crystallised in cubes.

In other respects similar to specimen No. 1.

This combination of lime with fluoric acid, is found near Middletown, Connecticut, in a vein, accompanied by crystallised quartz and carbonate of lime, with sulphurets of lead, zinc, and iron.

3. *Fluate of Lime from New-Hampshire.*

Colour, light green.

Transparent.

Specific gravity 3.16.

Its other characters agree with the preceding varieties.

Several specimens of this variety were found by Colonel Gibbs at Rosebrook's Gap, in the White Mountains. The pieces were small and detached, and from the indentations on their surface, they appear to have occurred imbedded.

The Fluoric acid, from its peculiar property of corroding glass, is now extensively used in England and France for engraving on that substance. The acid is obtained from the fluuate by any of the mineral acids, which, having a stronger affinity for the lime, unites with it, and fluoric acid is disengaged in a gaseous form, and is immediately applied to the surface of the glass, duly prepared with wax, as in engraving on copper with aqua fortis; or the acid is rendered liquid by being absorbed by water, and in this state is used for engraving. When found sufficiently compact, the fluuate of lime is by means of the lathe formed into vases, urns, columns, &c. This affords employment to many families at Derby in England, where fluates best suited for this purpose are found.

This substance often accompanies metallic ores, as those of lead, zinc, copper, tin, &c. It is sometimes used to promote the fusion of refractory ores, hence it has obtained its name of Fluor.

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## MINERALOGICAL PUBLICATIONS.

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*An Enquiry into the chemical characters and properties of that species of Coal lately discovered at Rhode-Island, with some observations on its application to the arts and manufactures of the Eastern States.* BOSTON.

THERE is no substance in the mineral kingdom, the discovery of which, in this country, claims more attention than that of coal; an article on which must depend the success of many of our most important manufactures, and which the increasing scarcity of our ordinary fuel is rendering every day more and more necessary for domestic purposes. We feel pleasure, therefore, in laying before our readers several useful extracts from this interesting pamphlet.

We shall commence with a description of the mineral strata, and the chemical qualities of the coal, as detailed by the author.

“The fossils which appear on the surface, in the neighbourhood of the Coal Mine, are argillaceous sand-stone, abundance of schistus, or shale, and white quartz in large detached masses. When the ground is penetrated a few feet, the appearances are such as to leave no doubt that the strata consist of what is called the true independent Coal formation. Shale and argillaceous sand-stone, abounding with vegetable impressions, present themselves first, and immediately under the sand-stone, Coal is discovered; in some places, even within six feet of the surface.

“The position of the bed is here, as is generally the case in the independent Coal formation, not horizontal or vertical, but forming an angle of about  $75^{\circ}$ , and the veins of coal appear to be separated from each other by various coloured sand-stones, which interpose between the seams. Though

all these substances belong to what is called the transition rocks, yet fine specimens of indurated talc and green Asbestos in capillary crystals, are also discovered, interspersed through the shale, and immediately covering the Coal. Substances, which it is difficult to account for, as they have been generally supposed peculiar to primitive rocks.

“ The veins of coal run nearly in the direction of east and west, and the stratum which is worked at present, appears to be about 14 feet wide ; so little change has as yet taken place in the course of the vein, that there is every appearance of its improving, as they proceed farther from the surface : with only fifteen workmen, they can raise at present, from ten to twelve chaldron of coal per day, besides keeping the mine free from water, from which they suffer little inconvenience.

“ The character of Rhode-Island Coal, is as follows :— Its colour is black, or greyish black, with a metallic lustre, it soils the fingers ; its fracture is slaty, but its cross fracture is conchoidal, and the sides of its natural divisions are sometimes covered with a ferruginous earth. It burns slowly, producing an intense heat, without smoke, and with a very light lambent flame ; but emits no sulphurous or bituminous vapour, and, when perfectly burnt, leaves a very small quantity of grey ashes. The unconsumed particles of it, retain their original colour and lustre.

“ Specific gravity from 1, 450 to 1, 750.

“ From the above description, little doubt can remain of the true character of this Coal ; but in order to ascertain with precision the quantity of ingredients which it contained, I examined it according to the rules so ably laid down by Kirwan, and as my object was principally to determine the proportion of carbon which it contained, as the substance upon which all its good qualities depend, I repeatedly deflagrated it with certain proportions of nitre, and uniformly found, when the experiment was made with proper attention, that 100 parts of coal, contained from 90 to 94 of carbon ; and in order to compare it in this respect, with the

charcoal in common use here, I found that it required more charcoal to saturate a given proportion of nitre, than it did of Rhode-Island Coal. These experiments were also confirmed by submitting 100 grains of the Coal to an intense heat in a crucible, which, after five hours, were reduced to six grains of ashes; those ashes, which consisted, perhaps, of an oxyd of iron and an earth, I had not leisure to examine; nor was it of much consequence in the main object which I had in view, which was, to ascertain the qualities of the coal as an article of fuel.

“The following table of the relative proportion of carbon, which it bears to some other mineral coals, may not be unacceptable.

100 parts of	Carbon.	Bitumen.	Ashes.	Sp. Grav.
Swansea,	74	22	4	1, 357
Whitehaven,	57	41	2	1, 257
Newcastle,	58	40	2	1, 71
Rhode-Island,	94	—	6	1, 750
Kilkenny,	97	—	3	1, 526
Anthracite of Haüy, }	64	—	36	1, 300

“Thus it appears that this coal is nearly a pure natural carbon or charcoal, resembling, in many of its properties, the Anthracite of Haüy, and approaching, as nearly as possible, to the description of Kilkenny Coal, but superior to the former, as containing vastly more carbon, and much to be preferred to the latter, as it contains neither pyrites or sulphur, substances which render that coal peculiarly disagreeable for domestic purposes.”

The next extract which we make, relates to the different purposes in the arts to which such coal may be applied; and as this is an important part of the subject, we shall give it in the author's own words.

“The manufacture of iron has become so general and extensive over the continent of America, that it has, perhaps, more than any other circumstance, contributed to raise the *price of fuel*; and, should it continue to increase, the woods

of the country cannot long afford a sufficient supply, in situations where such works can be carried on with the greatest advantage. Many of the most valuable mines must therefore be neglected ; in the neighbourhood of Rhode-Island in particular, this has already been the case ; and, though abounding in iron ore, the scarcity of fuel on the spot has discouraged the manufacture of it.

“ It therefore requires but little argument to shew the advantage that may be taken of this discovery. The Rhode-Island Coal is peculiarly calculated for the smelting of iron ore ; it bears the blast remarkably well, and, having no tendency to vitrify in the furnace, besides producing an intense heat, it may be applied with more economical views to this purpose, than charcoal. And as the arts progress in this country, and iron from its crude state is manufactured into steel, this coal may be used to advantage, as it seems to possess the peculiar qualities necessary for the manufacture of this article. Steel being nothing more than bar-iron, impregnated with a large proportion of carbon, either by fusion or cementation, it naturally follows that this coal, which consists principally of carbon, is as well calculated as possible, for the conversion of crude iron into so useful an article.

“ For the burning of lime, Rhode-Island Coal will also be found an useful substitute for wood. The steady and uniform heat which it gives, renders it superior to wood for this purpose, as when properly applied, all parts of the kiln will receive equal degrees of heat, and the lime will, of course, be burnt equally, without subjecting some parts of it to vitrification, while others are not affected by the heat, which is often the case in the general method of using wood for the purpose.

“ In all those processes which require a slow and uniform degree of temperature, such as evaporation, this species of coal is to be preferred, and I cannot, at present, point out one to which it is more applicable, than the manufacture of salt, an article of the first necessity, and to which, America

will, at some future period, find it necessary to pay more attention.

“ For the supply of the steam engine, and in general, for every species of furnace but the reverberatory, this Coal is well qualified, provided the grates are so constructed as to give a sufficient draft of air, without which it cannot be properly ignited. This, however, with the knowledge which we possess, here of the principles of combustion, is a matter of little difficulty ; and the circumstance of its never caking, or adhering in cohesive masses, as well as its affording so little ashes to choke the grates, renders it extremely convenient and æconomical : when once it is perfectly ignited, the fire is more durable than any other coal, and it requires less attention.

“ With these qualities, it is obvious that it is well calculated for breweries and distilleries ; for the purpose of drying and preparing malt, no other species of coal will answer so well, as almost all others contain so much sulphur, or other volatile substances, that they cannot be used without destroying its flavour. This fact is so well understood, that the maltsters, even of America, have hitherto found it necessary to import Kilkenny Coal, at a prodigious expense, for no other purpose but the use of the malt kiln.

“ The smith will find considerable saving when he becomes accustomed to the use of Rhode-Island Coal. I am perfectly aware that it is not calculated for every purpose of the forge, and that, as it cannot be brought to cake or adhere, it will not answer on those occasions, where, what is called by the smith, a hollow fire is required ; but still, for small work, and all the common purposes of the forge, it will be found sufficiently well adapted, and it has already been used with success by many of the smiths in the neighbourhood. I cannot at the same time omit stating, that the brazier, the bell-founder, and those who are engaged in the casting of metals, will perceive the great superiority which this Coal has over others. The intense and durable heat

which it affords, renders it an article peculiarly valuable to artists of this description.

For the burning of bricks, and the manufacture of earthen-ware, and all sorts of pottery, such Coal as this is particularly convenient. The total absence of all smoke or vapour, renders it an article of consequence, in particular for the finer kind of ware.

But the same circumstances that make it most eligible for such manufactures, render it unfit for the reverberatory furnace, which is used in refining a variety of metals, as well as for other purposes. No fuel being adapted for such furnaces, but those which produce considerable flame and smoke, such as the Virginia Coal, or wood, as the principle upon which these furnaces are erected, requires that the flame only should traverse the surface of the metal, without any part of the fuel being in contact with it."

Lastly—Some directions are given relative to the proper method of using the coal.

"Well-informed and enlightened men will easily understand, that such coal as this, when properly ignited, must possess all the qualities of carbon. To such persons I cannot always appeal, and as the difficulty of igniting this substance is much greater than that of charcoal, many are disposed to doubt that it has any advantage; all, however, that is required, is, that the furnace or grate should have a strong draft, and that a little more patience is bestowed in kindling the fire, than is usually afforded by those who are accustomed to the burning of wood. The coal should be broke into small pieces, and a proportion of charcoal placed under it; when this is set fire to, the draft of the flue should be increased by proper management of the door or register of the furnace, or by blowers applied to the chimney. In a short time the whole is ignited; it never requires stirring, and no further trouble is necessary but to keep the lower bars of the grate free from ashes, or any substance that would interrupt the free circulation of air. A fire made in this manner, will continue to produce considerable heat for

six or eight hours without a renewal of fuel, and with only an occasional attention to keep up the draft of the flue."

We have ourselves had an opportunity of comparing this coal with the description which has been here given of it, and have also seen it used ; and it is with much satisfaction we state that it promises very great advantages to the manufacturing interest of the country ; and we have no doubt, when its qualities are more generally known, that it will become a valuable acquisition to the artist.

*An Account of Experiments made on Palladium, found in combination with pure gold, by Joseph Cloud, an officer in the mint of the United States. [Transactions of the American Philosophical Society. Vol. vi.]*

A FEW years since, a metal, under the name of Palladium, or new Silver, was sold in London by the Mineral Dealers, with the following printed account of the properties it possessed, without mentioning the discoverer's name, or the source from whence it had been derived.

" 1. It dissolves in pure Spirit of Nitre, and makes a dark red solution. 2. Green Vitriol throws it down in the state of a regulus from this solution, as it always does Gold from Aqua Regia. 3. If you evaporate the solution you get a red calx that dissolves in Spirit of Salt or other acids. 4. It is thrown down by quicksilver, and by all the metals but Gold, Platina, and Silver. 5. Its specific Gravity by hammering was 11.3, but by flatting as much as 11.8. 6. In a common fire the face of it tarnishes a little and turns blue, but comes bright again, like other noble metals, on being stronger heated. 7. The greatest heat of a blacksmith's fire would hardly melt it. 8. But if you touch it while hot with a small bit of Sulphur, it runs as easily as Zinc."

The appearance of a new metal in so questionable a shape, induced several chemists to examine it, and among others Mr. Chenevix, who, after a series of experiments, supposed

it to be a compound of Platinum and Mercury. This was denied by Dr. Wollaston, who proved to be the discoverer, and asserted that it was a new metal obtained from Platinum; and it was from this source alone that this metal had been procured, until Mr. Cloud discovered it combined with gold in some ingots from the Brazils, which, with a number of others, had been deposited in the mint of the United States.

The ingots, containing the Palladium, differing so much in colour from the others, induced him to submit one to several experiments, "by which," says Mr. Cloud, "I discovered that the alloy was a compound of gold, and a metal that would resist the cupel, and was soluble in nitric and nitromuriatic acids. I therefore adopted the following mode of analysis, as the easiest, and at the same time a satisfactory evidence of the existence of a metal possessing the properties of palladium.

"Process 1st. The whole ingot was combined with double its weight of fine silver, and cupelled with a quantity of lead, equal to the weight of the compound.

"Pro. 2d. The cupelled metals were reduced to thin plates, and submitted to the action of boiling nitric acid, until the silver and palladium were dissolved. The solution, which was of a high brownish-red colour, was decanted, and the residual gold washed with pure water, which was added to the decanted solution.

"Pro. 3d. Pure muriatic acid was added to the metallic solution of process 2d, until no further precipitation took place, and the acid was in excess. The silver being completely precipitated, the fluid, which retained its red colour, was decanted, and the precipitate washed with pure water: the washings were added to the decanted fluid, now holding nothing but palladium in solution.

"Pro. 4th. A saturated solution of pure potash (carbonate of potash did not succeed so well, part of the palladium being held in solution by the carbonic acid) was added to the metallic solution from process 3d, until the whole

of the palladium was thrown down in form of a flocculent orange-coloured precipitate. The precipitate was collected on a filtre; was well washed with pure water, and dried.

“ Pro. 5th. A portion of the precipitate from the last process was put into a crucible, without addition, and subjected to a heat of about 60° of Wedgewood; and thus, a metallic button of palladium was obtained.

“ Pro. 6th. Another portion of the precipitate from process 4th was combined with black flux, and submitted to a degree of heat equal to that excited in process 5th, and similar results were obtained.

“ Having thus obtained a metal, which I supposed to be palladium, from a source heretofore unknown; in order still farther to satisfy myself, I separated that metal from crude platinum, and subjected them both to a number of comparative experiments, with prussiate of mercury, recent muriate of tin, and other re-agents, without discovering the least shade of difference.”

According to Mr. Cloud, “ Palladium is of a greyish-white colour; so closely resembling that of platinum, that they cannot be distinguished by their complexion. It is malleable, and very ductile; so that by the rolling-mill it can be reduced into thin plates. In hardness it is nearly equal to wrought iron. Its specific gravity, at 64° Fahrenheit, is  $11\frac{4}{9}$ . It may be alloyed with a number of the metals. With gold, silver, and platinum, it forms ductile alloys, and very much debases the colour of the two former.”

The above experiments of Mr. Cloud satisfactorily confirm the existence of Palladium as a substance possessing properties which entitle it to a place among the noble metals. We are also indebted to him for having pointed out this new metal in combination with gold, without the presence of platinum.

Since the discovery of Palladium by Dr. Wollaston, other new metals have been obtained from the ore of Platinum; and we are happy to learn that Mr. Cloud has been

extensively engaged in experimenting on Rhodium, one of these new metals, which he has obtained in great purity, an account of which, we hope, he will ere long lay before the public.

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*Geological Inquiries.*

THE following queries have been proposed by the London Geological Society, in order to facilitate, and, in some measure, to direct general research, with the view of collecting geological facts, so that mineralogical maps of districts, which are now so much wanting, may be supplied; that the nomenclature of the science may be gradually amended by the selection of the most correct and significant terms; that theoretical opinions may be compared with the appearances of nature; and, above all, a fund of practical information obtained, applicable to purposes of public improvement and utility.

As these inquiries may prove acceptable to those who are engaged in investigating the geology and mineralogy of the United States, we shall give them full insertion.

“Geology relates to the knowledge of the system of our earth, of the arrangements of its solid, fluid, and æriform parts, their mutual agencies, and the laws of their changes.

“In this point of view, it is necessarily connected with many branches of Natural Science, but it is more particularly dependent upon Mineralogy, which distinguishes the species of inorganic bodies; and upon Chemistry, which investigates the intimate nature of matter and its hidden properties.

“The knowledge of the general and grand arrangement of nature must be collected from a number of particular and minute instances, and on this ground the slightest infor-

mation relating to the structure of the earth is to be regarded as of some importance. The miner, the quarrier, the surveyor, the engineer, the collier, the iron master, and even the traveller in search of general information, have all opportunities of making geological observations; and whether these relate to metallic productions, the rocks, the strata, the coal of any district; or the appearances and forms of mountains, the directions of rivers, and the nature of lakes and waters, they are worthy of being noticed.

### *I. Concerning Mountains and Hills.*

“Are they solitary, or in groups, or do they form a chain?

#### *If Solitary,*

“The general figure, as conical, pyramidal, &c.—more particularly of the summits?

‘The height above their base, and above the level of the sea?

The length, breadth, and general form of a horizontal section passing through the base, or the *ground plan*; and the points of the compass between which the long diameter lies?

The degree of declivity on every side with regard to the circumjacent plain?

Do they present on any side abrupt craggy faces, and to what points of the compass are these opposed?

Do these precipices extend to the foot of the mountain, or are there at their bottom sloping banks of loose fragments?

Is the surface smooth or rugged?

—dry or marshy?

“To what height does vegetation ascend, and what are the prevailing plants in different parts of the ascent?

The springs, streams, lakes, hollows, gullies, caverns?

Whether any loose blocks of stone are found on the surface, different from those of which the mountain is composed?

*“ In addition to the preceding Inquiries,  
If in a group,*

“ Are the component mountains of nearly the same height ?

Which are highest, the central or external ones ?

*If in a Chain,*

“ The outline of the chain ?

Its highest point ?

Its length ?

Whether straight or curved, and extended between what points of the compass ?

Whether any lateral ridges proceed from the main chain ?

## *II. Concerning Vallies.*

“ Their geographical boundaries ?

Their length, breadth, depth ?

Are they occasionally dilated and contracted, or do their sides preserve an uniform parallelism ?

Is the bottom or floor even or rugged ?—nearly level or much inclined ? If inclined, whether regularly or interruptedly, and in what direction ?

Are the slopes that form their sides smooth and gentle, or rugged and precipitous ?

Do the opposite sides consist of the same kind of rock, and do they correspond in the inclination of their beds or strata ?

Are there on their sides depositions of water-worn and rounded pebbles, either loose or compacted, and to what height do they reach ?

Are the detached fragments, by which the bottom is overspread, angular or rounded ? of the same species of rock as composes the sides of the valley, or different ?

Of what description is the solid rock, or base, upon which these rest ?

“ Are they open or closed at one or both extremities ?

Do any subordinate lateral vallies open into the main one, and what remarkable circumstances occur at their junction ?

Do streams rise in or flow through them, and in what direction ?

### III. *Concerning Plains.*

“ Their shape and extent, with the nature, height, and general appearance of the hills or mountains, by which they may be bounded ?

The degree and direction of their inclination or slope ?

The nature and character of the different soils by which they are covered ?

Whether dry, or abounding in springs and standing waters ?

If traversed by streams, in what direction do they flow ?

Are the beds of rounded pebbles (if such occur) composed of minerals similar to those which form the surrounding mountains ?

Have any opportunities presented themselves, in sinking shafts or wells, cutting canals, excavating docks and quarries, and digging foundations, of examining the subjacent strata, and what are the results of such observations ?

### IV. *Concerning Rivers.*

“ Their source, their mouth ?

The direction and length of their course, and whether these are the same now as formerly ?

Their breadth, depth, and rapidity ?

What is the rate of their descent or fall ? is it uniform or interrupted ?

The amount of their periodical increase or decrease ?

The colour, temperature, and other properties of the water ?

Whether any part of their course is subterranean ?

“ Do they run in the same direction as the strata, or cross them, and at what angle ?

The nature of the bed, whether rock, mud, sand, or gravel ? Are the pebbles of the same rock as that of the adjacent country ?

*V. Concerning Lakes, Springs, and Wells.*

*1.—Lakes.*

“ The extent, depth, temperature, and other properties of the water ?

The periods and amount of their greatest annual increase and decrease ?

Whether supplied by springs or streams, and whether any streams flow out of them ?

Of what is the basin composed ?

Are there any appearances that indicate the extent to have been formerly different from what it is at present ; and does this alteration seem to have been gradual or sudden ?

Are there shoals of gravel and low lands in those parts where streams flow in ; and do these increase from year to year ?

*2.—Springs.*

“ The physical and chemical properties of the water—the nature of its deposit ?

The quantity discharged in a given time, and the degree to which this is affected by dry or wet seasons ?

The kind of rock from which the water issues ?

*3.—Wells.*

“ Their depth ?

The number, thickness, and species of strata, pierced through in sinking, and the order of their position ?

Whether all the wells of a district derive their water from the same stratum ?

Whether, when the water first flows, it rises rapidly and accompanied by sand ?

"Is the water liable to periodical increase or decrease ?

#### VI. *Concerning Shores and Coasts.*

"If the shore is flat, to what extent ? and whence are the sand and pebbles derived ? Are they part of the adjacent cliffs, or brought down by rivers, or deposited by the sea ? in what quantity, and of what description ?

If the coast is precipitous, the form and elevation of the cliffs, with the nature and disposition of the rocks which compose them ?

#### VII. *Concerning the Sea.*

"Its depth, tides, currents, inlets, nature of the bottom, &c. ?

The height to which it rises ?

What effects has it produced on the adjacent rocks, &c. ?

Are there any indications of its having formerly had a different level ?

#### VIII. *Concerning Rocks.*

"Their horizontal outline ?

Are they separated from each other by thin bands of clay, or other extraneous substances ? or slightly joined to one another ? or firmly welded together ?

When two rocks of different species come in contact, is any difference in colour, hardness, &c. observable between the adjacent surfaces and other portions of the same rock ?

When a rock terminates at the surface of the earth, are any fragments of it to be traced in the form of gravel, &c. ?— Does it re-appear after such interruption, and what is the nature of the intervening substance ?

The form of their broken ends ?

Are any rocks observed to terminate constantly together ? and what are they ?

#### *If Stratified,*

"Is the stratification distinct or indistinct ?

“ What is the number and thickness of the strata, and the order of their position ?

Do they alternate or recur at regular intervals ?

Do they, whether straight or waved, preserve their parallelism throughout, or are they cuneiform, &c. ?

When vertical, what points of the compass are opposed to their sides, and what to their edges ?

What is the amount of their dip, or the angle which they form with the horizon, and is it the same throughout their whole extent ?

To what point of the compass do they decline ?

Where several strata, of the same species, are incumbent on each other, do they differ in thickness or consolidation ?

Where veins, dykes, or fissures occur, are the strata depressed, elevated, contorted, or altered in any other way ?

How far does the external form of the mountain correspond with the position of the strata ?

If the stratum contains broad and thin distinct particles, (such as mica) do these all lie in the same direction ?

*Note*—Care must be taken in examining strata, not to be deceived by distance or perspective, or by mistaking fissures for stratification, and fallen strata for strata in their natural position ; and it should be kept in mind, that before the inclination of a stratum can be determined with certainty, it is necessary that it should be seen on two of its adjacent sides.

*If Unstratified,*

“ Are they amorphous, columnar, or in globular concretions ?

Do they split with the same ease in all directions, or have they what is called a grain ?

Do they abound in fissures, and what is the direction and extent of these ?

*IX. Concerning the Materials of Rocks.*

“Are they composed of one mineral substance, or of more? In the latter case, which has impressed the other?

Are they composed of parts cemented together, or adhering to each other without a cement?

Are they granular, slaty, porphyritic, amygdaloidal, or any compound of these? If Breccia, are the included nodules large or small, entire or broken, &c.?

Do they contain fragments of other rocks, and of what description? Sand? Shells? Corals? Vegetable impressions, or any thing that appears to belong to a different formation?

Are there hollow nodules, and in what manner are they lined?

Is there any character, by which substances found in one stratum can be distinguished from similar substances found in another? or by which, what have been called primary strata, may be distinguished from secondary strata, and strata of transition?

What minerals are found to be generally concomitants of others?

How are the several species affected by the combined action of air and moisture? Where large fragments have been torn by torrents from known rocks, what is the progress of their decomposition, and is there any re-aggregation?

What are the characteristic forms of each species of rock—in mountains?

in detached blocks?

How are they affected by peat moss lying on them?

What are the plants, the presence or absence of which indicates the nature of the soil?

By what local denominations are the different rocks distinguished, and to what æconomical purposes are they applied?

*X. Concerning Veins.*

“ Are they of the same materials as the rock in which they occur, or of any contiguous rock ?

What is their direction with regard to the points of the compass, and the inclination of the adjacent strata ?

Are they vertical, horizontal, or inclined, and at what angle ?

What are their several dimensions ?

Are they nearly of the same thickness at different depths ? Do they terminate in a wedge, and this at the top or bottom of the vein ?

Is their longitudinal course straight or curved ?

Is it of uniform breadth, or does it enlarge and diminish ?

Do they ramify, and in what direction ? Do the branches re-unite ?

In what order are minerals arranged, of which the vein is composed ?

Are there any fragments of other rocks, any pebbles, any organic remains among them ?

When a vein comes in contact with a different species of rock from that in which it was first observed, is the vein abruptly cut off, raised, depressed, turned aside, or are its materials altered ?

If a vein is cut off, or shifted by the interposition of a stratum or mass of rock, does it re-appear or recover its direction on the other side of the interposed body ?

Is it shifted or cut off without any apparent cause ?

Are neighbouring veins composed of the same materials ?

Have veins, consisting of similar materials, the same direction ?

What proportion do the several veins bear to the rock in which they are found ?

Do they run parallel to each other ?

Do they tend to a common centre ?

Do they cross each other, and what phenomena occur under these circumstances ?

What is the nature of their floor, sides and roof ?

Do the veins seem to have produced any change on the adjacent part of the containing rock, as indurating it, disturbing the regularity of its stratification, &c.?

Can they be traced to beds composed of the same materials as themselves?

### *XI. Concerning Organic Remains.*

"To what class, and species, do they belong?

Do they conform to the direction of the strata in which they occur?

Do particular shells, &c. affect particular strata?

What change have they undergone? Are the vegetables compressed, carbonized, bituminized, silicified, or penetrated with pyrites in whole or in part? Do the shells retain their enamel? The bones their phosphoric acid, &c.?

Do the shells, or other organic remains, appear perforated or worm-eaten?

What is the nature of the rock or bed in which they are found?

Are the bones disposed in entire skeletons? are those of different animals mingled together?

Are the shells worn, broken, crushed, or thrown out of their natural position? Are the different species confusedly intermixed?

Does this mixture extend not merely to species and tribes, but even to classes? i. e. are the remains of fish and sea-shells accompanied by those of land-animals and vegetables?

Are any analogous living species now found, or known to have been formerly found, in their vicinity or elsewhere?

Among the various organic remains, can any traces be observed of the existence of man?"

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## INTELLIGENCE.

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### *Mineralogy of the Brazils.*

BY letters lately received from Mr. Mawe, from Rio-de-Janeiro, dated the 15th August, we are informed that

he has obtained the Prince Regent's permission to travel and make observations in the mining district of the Brazils. He has already passed some months in the government of St. Paul's, where he discovered a variety of fine clays for the purposes of Porcelain, &c. He is lately returned from the mines of Canto Gallo. The gold mine of Santo-rita is between two rocks of sparry lime-stone, a substance not before known to exist in the country, nor would the inhabitants believe it until they saw it burnt into lime.

These districts, until now unexamined by any mineralogist, (in a country so rich in precious productions) cannot fail to be highly interesting to the lovers of Natural History.

*Philosophical Magazine, No. 133.*

*Columbium.*

Dr. Wollaston has lately found the Columbium of Hatchett to be the same metallic substance as the Titanium of Klaproth, or Menachan of Werner.

*Retrospect No. xix.*

PHILADELPHIA LINNÆAN SOCIETY.

*The following Gentlemen have been chosen Officers for the present Year.*

<i>President,</i>	Benjamin Smith Barton.
<i>Vice-President,</i>	Samuel B. Smith.
<i>Curators,</i>	} John H. Lambert, Samuel Hazard.
<i>Corresponding Secretary,</i>	
	Aaron Dickerson.
<i>Recording Secretary,</i>	} Joseph G. Shippen.
<i>Committee on Mineralogy,</i>	} Charles S. Wister, Samuel Hazard, James Cutbush, Walter Channing.
<i>Committee on Botany,</i>	} John H. Lambert, N. S. Allenson, Samuel Benezet, Aaron Dickerson.

Committee on Zoology,	}	Samuel B. Smith, Samuel Stuart, Benjamin Keighler, Archibald M'Kinney, Joseph G. Shippen, George S. Schott, Roberts Vaux, Samuel Jackson.
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(Circular.)

SIR,

Philadelphia.

IT is in conformity with the directions of the Philadelphia Linnean Society, and in their behalf, that we have now the honour of addressing you. The principal object in establishing this Society was the promotion of Natural History, and particularly that of our own country. In the whole circle of science, there is nothing more pleasing, more interesting, or more beneficial, than the study of nature; and of all the countries in which this study can be pursued, there is certainly none that presents greater advantages than America.

Without doubt, the only practicable method of obtaining a history of the natural objects of our country, is to concentrate the observations made in its various parts. We, therefore, beg of you, Sir, as a member of the Linnean Society, and as a lover of science, that you would communicate to us the result of your observations on natural history, particularly that of your own neighbourhood.

It is not, by any means, our wish, to direct or to limit your inquiries. Your remarks on any of the branches of natural history, we will always receive with pleasure. One suggestion, however, we take the liberty of making—Our Society is now forming a cabinet of plants and minerals, the usefulness of which must, in a great measure, depend on its extent and perfection. In order to advance this undertaking, we beg you to communicate specimens of the plants and minerals of your vicinity, accompanied by notes designating their scientific and vulgar names, when they can be

obtained, their locality, and, in regard to plants, their time of flowering. To these necessary notes you will add such other observations concerning them, as you may deem interesting or useful.

Should you, Sir, in compliance with these wishes, favour the Society by a communication, you will please to direct it to either of the subscribers, and may be assured of a prompt acknowledgment.

We have the honour to be, Sir,

Your humble servants,

*Corresponding Committee of the  
Philadelphia Linnean Society,*

{ SAMUEL HAZARD,  
SAMUEL BETTON, Jr.  
S. COLHOUN.

*Mr. Greville.*

The English Journals of June last announce the death of the Right Honourable Charles F. Greville, brother to the Earl of Warwick, and nephew to the late Sir William Hamilton. The friends of mineralogy, and the science itself, have suffered a great loss in the death of this gentleman. More than thirty years ago he purchased, and removed to England, the collection of the celebrated De Born, and with it introduced that taste for mineralogy which is now so much diffused through that kingdom. He afterwards added an immense number of minerals from every part of the globe. He frequently received specimens from the East Indies, over land, by the messengers of government. Thus his collection, before his death, had become, for the beauty of the specimens and their immense variety, the first in the world. Mr. Greville did not neglect the other sciences: he had a large herbary, which he had collected himself, and in his garden were to be found the rarest plants of Asia and America. The Philosophical Transactions contain a number of papers written by him, which shew both the variety and solidity of his knowledge. Early in life he visited the different seats of the arts and sciences in Europe; and during a long residence in Italy, the nephew of Sir William Hamilton acquired that superiour taste in

the fine arts, which has since enabled him to assist their progress in his own country. It may be easily supposed, that with the name and influence of the illustrious house of Warwick, the genius of such a man as Mr. Greville would not leave untried the more usual walks of ambition: but having sided against the Court in the memorable American war, he lost its favour, and philosophy had him for her own. He did not, however, refuse to his country the knowledge of his comprehensive mind: he afterwards held a seat in the council of his Sovereign, and became a Member of the Board of Trade.

In his private life, Mr. Greville was strongly characterized by his liberality towards the unfortunate; his income was frequently straitened in the relief of indigent merit. Those who knew him will testify to the dignity of his deportment, and the suavity of his manners. He was accessible to all those who were desirous of information; few left him uninstructed; none left him dissatisfied.

A few years before his death, his health becoming impaired, Mr. Greville removed to a pleasant villa in the neighbourhood of London. There, surrounded by what was most beautiful and rare in the productions of nature and art, he waited with calmness the termination of a life, which had been honoured by virtue, and adorned by science.

G.

*Manufacture of Chemical Tests and Reagents.*

We announce, with pleasure, the establishment of Mr. G. Chilton for the manufacture of Tests, Reagents, and various chemical preparations, indispensably necessary to the student and man of research. Few, even among scientific persons, are willing to bestow the time and labour, which the preparation of Reagents require; and as the want of them has been no inconsiderable difficulty attending chemical and mineralogical pursuits, we hope this arduous and important undertaking will meet with due support and encouragement.

## APPENDIX.

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In page 53, of the present number, we have inserted a notice from the Retrospect relative to Columbium. We have just received the Philosophical Magazine for March last, which contains the following paper from the Transactions of the Royal Society, by which it appears that Columbium proves to be the same as the Tantalum of Ekeberg, instead of the Titanium of Klaproth.

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*On the Identity of Columbium and Tantalum. By WILLIAM HYDE WOLLASTON, M. D. Sec. R. S.\**

**W**ITHIN a short time after the discovery of columbium by Mr. Hatchett in 1801,† a metallic substance was also discovered in Sweden by M. Ekeberg,‡ differing from every metal then known to him; and accordingly he described the properties by which it might be distinguished from those which it most nearly resembled. But although the Swedish metal has retained the name of Tantalum, given to it by M. Ekeberg, a reasonable degree of doubt has been entertained by chemists, whether these two authors had not, in fact, described the same substances; and it has been regretted that the discoverers themselves, who would have been most able to remove the uncertainty, had not had opportunities of comparing their respective minerals, or the products of their analyses.

As I have lately obtained small specimens of the two

\* From Phil. Trans. 1809, Part II.

† Phil. Trans. for 1802.

‡ *Vetenkaps Academiens Handlingar*, 1802. p. 68.—*Journal des Mines*, vol. xii. p. 245.

Swedish minerals tantalite and yttrite tantalite, from which I could obtain tantalum, and was very desirous of comparing its properties with those of columbium, Mr. Hatchett very obligingly furnished me with some oxide of the latter, which remained in his possession.

The resemblance was such in my first trials, as to induce me to endeavour to procure a further supply of columbium ; and by application to the trustees of the British Museum, I was allowed to detach a few grains from the original specimen analysed by Mr. Hatchett.

Notwithstanding the quantity employed in my analyses was thus limited, I have, nevertheless, by proportionate economy of the materials, been enabled to render my experiments sufficiently numerous, and have found so many points of agreement in the modes by which each of these bodies can or cannot be dissolved or precipitated, as to prove very satisfactorily that these American and Swedish specimens in fact contain the same metal : and since the re-agents I have employed are in the hands of every chemist, the properties which I shall enumerate are such as will be most useful in the practical examination of any other minerals in which this metal may be found to occur.

In appearance the columbite is so like tantalite, that it is extremely difficult to discern a difference that can be relied upon. The external surface, as well as the colour and lustre of the fracture, are precisely the same ; but columbite breaks rather more easily by a blow, and the fracture of it is less uniform, appearing in some parts irregularly shattered ; nevertheless, when the two are rubbed against each other, the hardness appears to be the same, and the colour of the scratch has the same tint of very dark brown.

By analysis also, these bodies are found to consist of the same three ingredients ; a white oxide, combined with iron and manganese.

Either of these minerals, when reduced to powder, is very readily acted upon by potash ; but as the iron contained in

them is not affected by alkalies, it appeared better to add a small proportion of borax.

Five grains of columbite being mixed with 25 grains of carbonate of potash and ten grains of borax, were fused together for a few minutes, and found to be perfectly incorporated. The colour was of a deep green, from the quantity of manganese present. The mass, when cold, could be softened with water, and a portion of the oxide could be so dissolved; but it seemed preferable to employ dilute muriatic acid, which, by dissolving all other ingredients, excepting columbium, left the oxide nearly white, by the removal of iron and manganese, that had been combined with it.

The muriatic solution having been poured off and neutralized with carbonate of ammonia, the iron was then separated by succinate of ammonia; after which the manganese was precipitated by prussiate of potash.

The products thus obtained from five grains of columbite, after each had been heated to redness, were nearly,

White oxide..... 4 grains.

Oxide of iron..... $\frac{1}{4}$

Oxide of manganese....  $\frac{1}{4}$ ;

but it cannot be supposed that *proportions* deduced from experiments made on so small a scale can be entirely depended upon, although the *properties* of bodies may be so discerned, nearly as well as when larger quantities are employed.

An equal weight of tantalite taken from a specimen, of which the specific gravity of 7.8, yielded, by the same treatment,

White oxide.....  $4\frac{1}{4}$  grains.

Oxide of iron.....  $\frac{1}{2}$

Oxide manganese .....  $\frac{1}{10}$ .

The white oxides obtained from each of these minerals, are remarkable for their insolubility in the three common mineral acids, as both Mr. Hatchett and M. Ekeberg have observed.

In muriatic acid they cannot be said to be absolutely in-

soluble; but they are not sufficiently soluble for the purposes of analysis.

In nitric acid they are also nearly, if not perfectly, insoluble.

In sulphuric acid, when concentrated and boiling, the oxide of columbium may be dissolved in small quantity, and so also may the oxide obtained from tantalite.

The proper solvent, as has been observed by Mr. Hatchett and by M. Ekeberg, is potash; and as it is not required to be in its caustic state, I employed the crystallized carbonate of potash on account of its purity and uniformity. Of this salt about eight grains seemed requisite to be fused with one of the oxide, obtained from either of these minerals, to render it soluble in water.

Soda also combines with the oxide, and may be said to dissolve it: but a far larger proportion of this alkali is necessary, and a larger quantity of water. And although a solution may have been effected that is transparent while hot, it very soon becomes opaque in cooling, and finally almost the whole of the oxide subsides, combined with a portion of the soda, in a state nearly insoluble.

When a solution of the white oxide, obtained from either of these minerals, has been made, as above, with potash, the whole may be precipitated by the addition of an acid, and will not be re-dissolved by an excess of sulphuric acid, of nitric, of muriatic, succinic, or acetic acids,

But there is a further agreement in the properties of these two minerals, which appears above all others to establish their identity; for though they are both so nearly insoluble by any excess of the mineral acids, yet they are each completely dissolved by oxalic acid, by tartaric acid, or by citric acid; and the solution of each is subject to the same limitations; for if the precipitate has been dried, it is become intractable, and can scarcely be dissolved again till after a second fusion with potash.

If to the alkaline solution of either of them there be added infusion of galls, prussiate of potash, or hydro-sulphuret

of potash, no precipitate occurs; but when a sufficient quantity of acid has been added to neutralize the redundant alkali, the infusion of galls will then occasion an orange precipitate; but prussiate of potash causes no precipitate, nor does the hydrosulphuret precipitate the oxide, although the solution may become turbid from precipitation of sulphur by a redundant acid.

The characteristic precipitant of columbium is consequently the infusion of galls; but in the employment of this test, certain precautions are necessary. For, as an excess of potash may prevent the appearance of this precipitate, so also may a small excess of oxalic or tartaric acids prevent precipitation, or dissolve a precipitate already formed. A larger excess of citric acid seemed requisite for that purpose, and would also dissolve the gallat of columbium. In each case the precipitate may be made to appear by neutralizing the redundant acid; and for this purpose carbonate of ammonia should be employed: for although pure ammonia has no power of dissolving the oxide alone, yet the gallat seemed to be perfectly redissolved by that alkali.

When infusion of galls is poured upon the white oxide, recently precipitated, and still moist, it combines readily, and forms the orange-coloured compound.

Prussiate of potash occasioned no change in an oxide that had been purified by a second fusion with potash; but it appeared to dissolve a small portion of the oxide, as infusion of galls, poured into the clear liquor, occasioned a cloudy precipitate of an orange colour, though no such precipitate took place when the infusion was mixed with the same prussiate alone.

Hydro-sulphuret of potash being added to the oxide, and heated upon it, impaired the whiteness of its appearance, and seemed to detect the remains of some impurity which had not yet been removed by other means; but no appearance indicated the formation of a sulphuret of columbium.

From a careful repetition of these experiments upon each of the oxides, I see no reason to doubt of their perfect

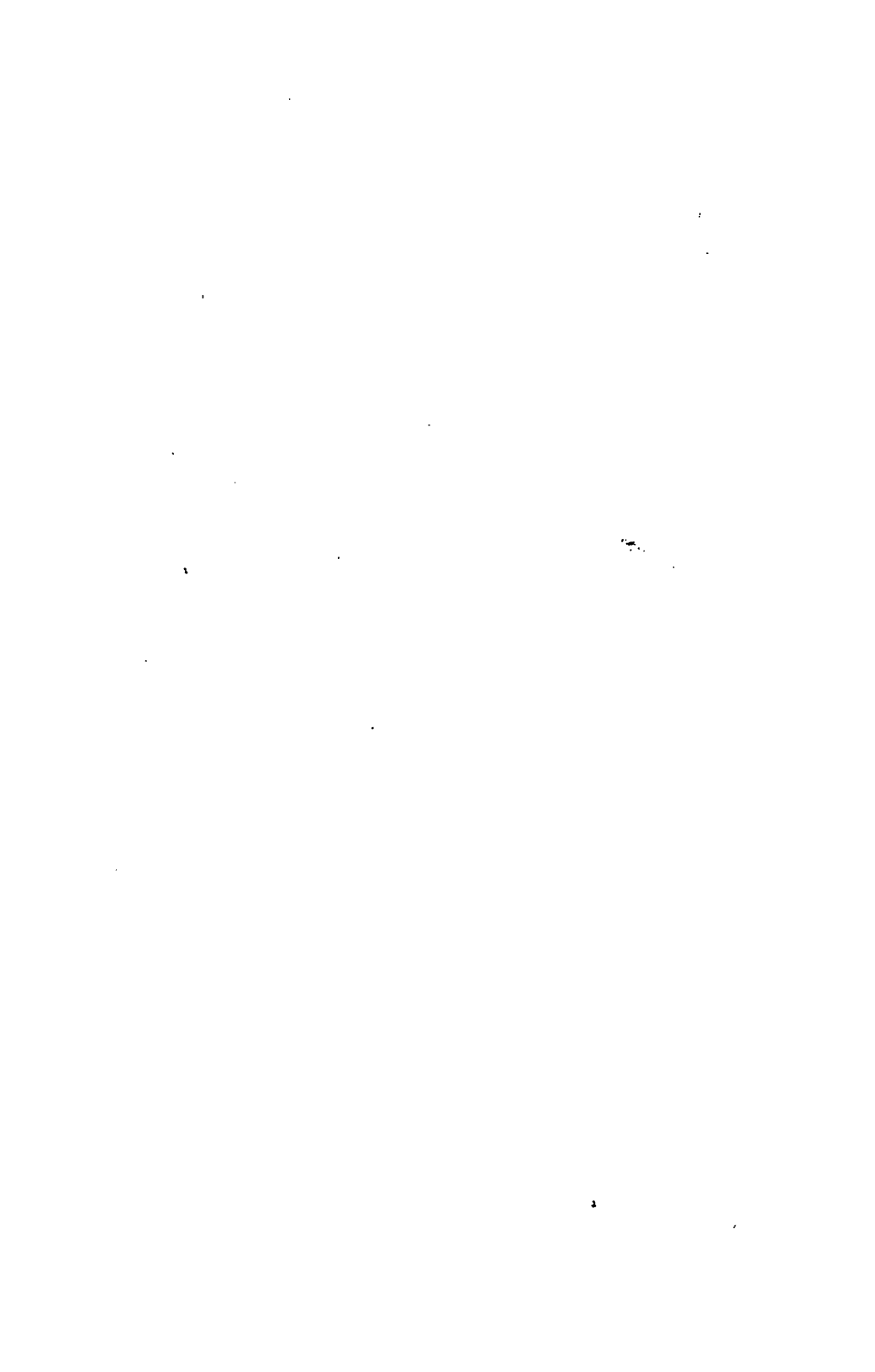
agreement in all their chemical properties; but there is, nevertheless, a very remarkable difference in the specific gravities of the two minerals from which they are extracted.

The specific gravity of columbite was ascertained by Mr. Hatchett to be 5.918; that of tantalite was found by M. Ekeberg to be 7.953; and I have every reason to suppose their results correct, since a small fragment of the former appeared upon trial to be 5.87, while a specimen of tantalite, weighed at the same time, was as much as 7.8. I should, however, observe, that the specific gravities of three other fragments, borrowed for this purpose, were not so high, that of one being 7.65, of another 7.53, and of a third so low as 7.15.

It is evident that no variation of mere proportion of the ingredients can account for an increase of specific gravity from 5.918 to 7.953, which are in the ratio of 3 to 4; for since columbite contains four fifths oxide, if the whole remaining one fifth part in weight of that oxide could be supposed added to the same bulk, without diminution of the quantities of iron and manganese, the specific gravity would not then exceed 7.1; and even if a weight equal to one third of the whole were thus added, without increase of bulk, still the aggregate would not quite equal the heaviest tantalite in specific gravity; but, on the contrary, the quantity of white oxide in this specimen certainly does not amount to six sevenths, and probably is not more than five sixths of the whole mass.

The only chemical difference, by which this circumstance could be explained, would be the state of oxidation, which my experiments cannot appreciate; but it may also arise in part from actual cavities in the mass of columbite, and in part from the state or mode of aggregation.





THE AMERICAN  
MINERALOGICAL JOURNAL.

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NUMBER II.

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XII. *Particulars relative to the LEAD-MINE near Northampton, (Massachusetts.)* By BENJAMIN SILLIMAN, *Professor of Chemistry and Natural History in Yale College, Connecticut.*

TO DR. BRUCE.

Dear Sir,

IN the month of May last, at the request of the proprietors, I visited the Lead-Mine near Northampton, and the following account was drawn up *as a report*, for their use. It is now, with their consent, forwarded to you, and you have mine to insert it in your Journal, if it comes within your design. It would have been written differently, in some respects, had it been originally intended for a scientific journal, but I have not now time to give it a new form.

Very respectfully,

Your obedient servant,

B. SILLIMAN.

Yale College, Aug. 30, 1810.

LOCATION.

The mine is situated about eight miles from Northamp-  
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ton, in a southwesterly direction, and, of course, at the same distance from the great river Connecticut, which affords all necessary facility of transportation to and from the ocean.

#### NATURE OF THE COUNTRY.

The country immediately contiguous to the river, is generally alluvial, consisting of beautiful meadows. These are bounded, at no great distance from the river, by hills and mountains, composed chiefly of granite, trap and gneiss. They are sometimes abrupt and lofty, but generally rather undulating, and bounded by pretty large curves. Of the latter description is the country in which the mine in question is situated; it may be called very hilly, although it is hardly mountainous.

#### THE ROCK AND THE VEIN.

The rock, at those places which I visited, is granite. As I observed gneiss in several places on the hills, it is highly probable that the vein may be sometimes bounded by gneiss and sometimes by granite. I did not see any trap near the mine. The vein, including every thing it contains, is a very magnificent one. It is six or eight feet in diameter, and is known to extend twenty miles; from Montgomery on the southwest, to Hatfield on the northeast. It has been opened at these, and at many intermediate places, and it is more than probable that these are not its ultimate limits. The walls of the vein are very distinct and well defined. They are generally parallel, and incline at an angle of twelve or fifteen degrees, from a perpendicular to the horizon. The bulk of the vein is filled with quartz, which, with sulphat of barytes, and a little crystallized carbonat of lime, constitutes the gangue or matrix of the metallic matters. The quartz is so compact as to need blasting with gunpowder, without which no progress can be made in the mine; and yet, it is often crystallized so that the large masses which the explosion rends from the rock, are easily shivered

into pieces by the blow of a hammer. There is a tendency towards crystallization every where manifested in this vein, which makes it an extremely interesting object to a mineralogist, and affords the miner great facility in reducing the gangue to fragments, and in disengaging the ore. Wherever there is a cavity in the vein, the quartz has shot into numerous crystals, usually very regular, sometimes large, and often so beautiful and brilliant that the cavities look as if studded over with gems. Many of them are sufficiently perfect and beautiful to deserve a place in the choicest cabinets; and hundreds of specimens may be selected, among the rubbish of this mine, more interesting than a majority of those which are preserved in costly collections. They may be observed even on the surface of the earth; where the vein appears among the rocks, they have been, in some instances, so long exposed to the weather that they are worn down, and their points and angles rounded. Even where there is no cavity in the quartz as it lies in the vein, its structure is often so far crystalline that it exhibits, in the mass, a radiated or columnar appearance, and breaks with the greatest ease at the natural joinings between the crystals.

#### THE ORE.

The ore for which the mine is worked, is galena. It is both of the broad foliated kind, commonly called potters' lead ore, and of the small foliated kind, usually denominated steel-grained ore. But a small part of the whole vein is filled with the ore; the greater part of the vein is quartz, and among this the lead ore is irregularly interspersed, in masses, from the fraction of an inch, to more than a foot in diameter. It predominates most near the walls, and, at present, is found, in greatest abundance, near the eastern side of the vein. It appears to be a very pure and rich ore, and, where it exists at all, very little intermixed

with any other matters. It sometimes forms continued veins in the quartz, although it is often interrupted by it; but it immediately appears again, generally at the distance of a few inches, and thus the whole vein of quartz appears more or less spotted and clouded with the lead ore.

The lead was said, by the miners, to increase in quantity as they descended. Indeed, there appears to be enough of the ore to afford large quantities of the lead; it is, however, situated in so hard a rock, that considerable expense must necessarily be incurred in procuring it; and much more in bulk of the rock than of the ore, is separated in the blasting. Were the vein situated in Derbyshire, and were the gangue calcareous, as in the mines at Castleton, there can be no doubt that the enterprise would be vigorously pursued; and, in a country like this, there can be no question of the propriety of prosecuting the undertaking, till at least the average return can be ascertained, by smelting the ore, and bringing it to market. The great extent and width of the vein, seem to indicate an extensive deposit of lead; and although this, like every other mining operation, is necessarily involved in a degree of uncertainty, it is clearly worth a few thousand dollars to ascertain a question so interesting to this country, and which, should the ore prove abundant, and be procured without too much expense, may prove lucrative to the adventurers.

#### THE MINE.

The shaft was opened before the American war, and, after being neglected for forty years, was again opened in the month of October, 1809. It is now sunk about 60 feet; the whole breadth of the vein, at this place, has been excavated, and they have proceeded horizontally, perhaps, 25 or 30 feet. A pair of buckets, each of the capacity of 40 gallons, are constantly traversing the shaft to raise the water and the ore; the water runs down the walls of the

vein in abundance ; and it is therefore necessary to keep the buckets incessantly in operation. The quantity of water will doubtless be diminished in the summer ; and in any event the steam engine would afford effectual relief : but the vein is so situated that the water may be drained off from the present depth, and probably from situations considerably lower, by forming a level or gallery to meet the present shaft, at right angles, in the earth. If the level were carried from the southeast, at right angles to the course of the vein, it is probable that the water might be drained off by a gallery of fifty rods in length ; but, as the excavation would, in that case, traverse rocks where no ore could reasonably be looked for, a considerable expense would be incurred without any immediate remuneration. Therefore, as the country descends in the course of the vein, and, at the distance of one third or one half a mile, a small river runs along in a low bed, and as there can be no doubt that the vein of lead ore passes under the river, since it is found on both sides, it would, for these reasons, be best to discover the vein at the river, or in some of the contiguous low grounds, and then to follow it up to the present shaft.

The vein may be certainly discovered by *cross-cutting* the country, and, when found, it would probably more than pay for digging the level, since the level would be carried along in the vein itself. It would be as well to obtain the ore there, as in any other place ; the water would be running down constantly towards the river, and would not accumulate ; and when the level is carried through to the present shaft, it may be carried still farther up the hill, if the vein in that quarter should prove inviting, of which there are strong indications.\* The lead appears on the

\* *Note.*—While I was at the mine, they opened the vein at a situation farther up the hill ; the appearances were then promising, and I am lately informed, that the mining operations are now carried on principally there, and with good success. Several interesting minerals, never before observed in this

face of the ground, or is discovered by merely removing the soil or breaking off fragments of the rock. This may be still farther said in favour of carrying a level from the river, or low grounds near it, that it would not be necessary to dig down from the surface of the ground, but merely to excavate a passage, which would be a kind of subterranean road, and the walls and the roof being of rock, would need no artificial support. This is, indeed, a great advantage in the working of this mine, and forms a compensation for the hardness of the rock, which is not to be disregarded.

Besides the galena, there are found in this mine copper pyrites, dendritic delineations of manganese, and blende: neither of these ores appears to be abundant; the blende is but little valued as an ore of zinc; it is very difficult to obtain metallic zinc from it; and in England it is often (under the name of Black Jack) thrown away as worthless, or used to mend the roads. It is sometimes converted into white vitriol, or sulphat of zinc; but the quantity of this substance which is used is small, compared with what might be produced from blende, were it extensively manufactured into white vitriol. I have not heard that Calamine has been found in this mine.

The copper ore which is found here, is the same that is wrought in Cornwall, and the neighbouring country of Wales.\* The lead from this vein is sometimes beautiful-

country, are said to have been found at the new opening, within a short time; but, as I have never seen any of the specimens, I forbear to mention them, leaving it to those who have had better opportunities of ascertaining the truth. I cannot, however, omit to remark, that, a few days ago, some specimens were sent to me from this mine, containing *float of lime*; they were first pointed out, as such, by Dr. Bruce, who has recently visited the spot. In my specimens the prevailing colour is green, but there are spots of purple and blue; the structure is lamellar, the green pieces are translucent, and a few cubical crystals occur, chiefly imbedded in sulphat of barytes.

This vein, and the country around it, are becoming more and more important to science. There will probably be no great hazard in asserting, that this vein is the most interesting one that has ever been opened in this country,

\* In the new mine, the copper ore is found in considerable quantities; a small vein of it has been discovered.

ly crystallized in cubes. I have specimens from this mine, in which the crystals, of lead alone, with equally beautiful ones of blende, are deposited upon those of quartz, and in cavities lined with fine quartz crystals; the aggregate forms superb pieces for a cabinet.

#### ACCIDENTAL ADVANTAGES.

This mine is situated in a country where wood is abundant and cheap, and where, therefore, the smelting can be performed with comparatively little expense, since a wood fire is considered as very well adapted to this operation; for, as it is performed in a reverberatory furnace, the copious flame of wood is particularly advantageous. There is also the advantage of a good stream of water, within half a mile. This stream is sufficiently powerful to work the stamping machines, and carry bellows by water, should any be needed; it may also serve a useful purpose in dressing the ore, and helping to free it from its strong matrix.

May 16, 1810.

P. S. Since this account was written, I have subjected the lead ore of the mine described above, to a chemical examination, of which I will mention merely the results. By processes conducted in such a manner as to resemble, as nearly as possible, the operations *in the large way*, the ore affords from 50 to 60 per cent. of good soft lead; specimens, perfectly freed from all foreign matters, will yield more; but it is better to take an average rather below than above the truth. I obtained a silver globule in every instance, in eleven different operations, by cupellation, but the proportion of silver is too small to admit of profitable extraction; it is only  $12\frac{1}{8}$  oz. to the ton.

**XIII.** *The Physical Geography of the first range of Mountains extending across New-Jersey, from the Hudson to the Delaware; with some experiments on the Chalybeate Spring at Schooley's mountain. By the Honourable SAMUEL L. MITCHILL, M. D. M. C. &c.*

**T**HERE had been so much conversation about Schooley's mountain, that, in the beginning of July, 1810, I executed the desire I had long entertained, of visiting it.

Schooley's mountain is part of the granitical chain which extends in a north-easterly and south-westerly direction, across the state of New-Jersey. It may be traced from the Highlands of New-York. Towards the Hudson, its ridges divide the plains of Rockland county from those of Orange, being denominated the Haverstraw, Warwick, Skunemunk, and Stirling mountains, and being distinguished locally by several other names. Beyond the Hudson, in Westchester and Dutchess counties, it is called the Fish-kill and Peekskill mountain, Joe's Hills, Anthony's Nose, Sugar-Loaf, Breakneck-hill, and several other names. It trends away first to the east and north-east, and then to the north by Quaker-hill, separating the waters which fall into Long-Island Sound. Towards the Delaware, it separates the upper waters of the Raritan from those of the Musconetuncunck, and passes from Sussex through Morris and Hunterdon counties, is called, somewhat to the southward of Philipsburgh, the Musconetuncunck mountain. The more noted portion of its middle region is termed Schuyl's Hills, or Schooley's Mountain. The latter name is the most prevalent, and is derived from a family which was formerly a considerable proprietor of the soil thereabout. The former appellation is probably a mere abbreviation or corruption of it.

This ridge discharges the water from its north-west side,

partly through the Wallkill, into the Hudson, a little to the eastward of Esopus, after traversing Sussex county in New-Jersey, and Orange and Ulster in New-York. Part also empties into the same river through Murderer's and Chambers's creek, near New-Windsor. Another portion is collected into the Musconetcunck river; and running almost parallel with the mountain, falls into the Delaware, not many miles south of Easttown. The water from the south-east feeds, as it passes between the spurs or transverse ridges, the Ramapagh and the upper streams of the Passaick, which, after visiting Orange, Rockland, Morris, Essex, and Bergen counties, falls into Staten-Island sound, to the southward of Newark. The stream called the Black river, beyond Mendham, and that termed South-branch, watering Dutch Valley, neither of them reach the Delaware, but empty into the Raritan, some distance above Brunswick.

Thus these heights completely divide the waters of New-Jersey. Not a single stream is known to pierce them. From their north-western slope, all their streams find their way into the Hudson and the Delaware. From their south-eastern declivity, their currents travel to the ocean by Newark and Raritan bays. They have, however, no prétensions to be classed with the Shawangunk mountains, which are a distinct chain, and make part of the great Alleghany, that traverses the continent to the confines of Georgia. Nor have they any connexion with the Catskill mountains, which are themselves quite detached from the Shawangunk. Schooley's mountain is of more moderate elevation than either. Geometrical measurement has ascertained that the height of Schooley's mountain, above its immediate base, is more than six hundred feet. And a calculation, made by approximation, on the falls of water at the different mill-dams along the hurrying channel of the Musconetcunck, to its junction with the Delaware, and on the descent thence to Trenton, make the position of that

base to be nearly five hundred feet more above tide-water. The elevation above the level of the ocean does not, therefore, in all probability, much exceed eleven hundred feet. And this is about the height ascribed to Anthony's Nose, in the Highlands of New-York, by Mr. Knight.

The elevation is, nevertheless, considerable enough to influence its temperature. The heats of summer are not so great in the valleys. Droughts are less common, and snow falls earlier and lies longer than in the adjacent plains. The warmth of a copious spring of pure water, as it issued out of the sand near the top of the mountain, was only 50 degrees, while the temperature of the water gushing from the briskest springs on the north side of Long-Island, and drawn from the deepest wells at New-York, is 54 degrees. The spring water on the summit of Schooley's mountain is, therefore, four degrees colder than that around New-York.

This mountain is not a mass of stratified rocks, piled upon each other from bottom to top. There is no peculiar difficulty in travelling over it. The predominating materials are clay and sand, forming a good loam; which, though generally not argillaceous enough for the formation of bricks, is, at the same time, gravelly enough for the growth of grass and grain. Yet rocks are thickly distributed over its face and along its sides. They are mostly detached, though some of them are of large dimensions. They consist chiefly of feldspar and quartz. The quartz is prone to be semi-pellucid, and is granular or angular, resembling coarse marine salt. The feldspar is mostly whitish, sometimes reddish, and presents less of the polished fracture than the American feldspars usually do. It has the appearance of a more imperfect formation, or of having undergone a partial decomposition. These two ingredients make up the bulk of the rocks. Many masses may be examined without observing a vestige of mica. Abundant as mica is almost every where, in these parts, with the mix-

tures of feldspar and quartz, in our primitive rocks, it is remarkably deficient here. Now and then a little shistus, or hornblende, is found embodied and compacted with the quartz and feldspar. Grains of yellow pyrites also sometimes occur. Rust, ochre, and other indications of iron, are dispersed extensively, both through the rocks and the soil. Iron ore is indeed so plentiful, that furnaces are in operation, both in the eastern and western districts of the chain. Much of it is magnetical, and its action is so powerful upon the needle, that surveyors of land often find it very difficult to employ the compass. It would be possible to collect great quantities of the magnet, and of other ores of iron in the middle region. Towards the foot of the hills, limestone is found skirting the valleys along, and is calcined in quantity sufficient for all economical uses.

Among the natural productions thereabout, are masses of excellent flint stones. They lie along the valleys and side hills, where they have been washed bare; and serve both in quantity and quality for musketry. They are more pure, and of a better fracture, than those contained in the limestone near Niagara; and when this important article of public defence shall be thought worthy of being improved by the citizens, there seems to be in New-Jersey a good supply.

The feldspar appears to be of that variety which is fit for the porcelain manufacture. The rocks may be split by gunpowder, and afterwards comminuted by the hammer. There is little mica to incumber the separation; and the quartz can be easily divided from the feldspar. If this should prove to be the real petanse, it will be of great consequence in the progress of the arts.

A turnpike road has been completed from the city of Jersey, at Powles-hook, to the summit of Schooley's mountain. The travelling is excellent, the whole distance. This is just fifty miles from New-York city. Estimating the width of the Hudson to be two miles, the distance of Newark is

nine, to Springfield seven, to Chatham five, to Morristown seven, to Mendham six, to Black River six, to Dutch Valley five, and to the Mineral Spring on the eastern or further side of the mountain, three miles. Through such a succession of thriving villages, and amidst a country pleasingly checkered with forests and farms, the rise of the first five hundred feet is surmounted in about forty-seven miles, as the traveller passes over a surface of easy elevations and depressions. The remaining six hundred feet are ascended in less than two of the remaining miles, between Dutch Valley and the summit. The principal part of the remainder, is a descent to the Spring on the opposite declivity.

An able horse will bring a chair hither from New-York, in a summer's day; or return hence between the rising and setting of the sun. From the top of the mountain one finished turnpike is continued northward, to Sussex, and another westward, to Eastown, and a third eastward, to New-York. It is in contemplation to open a fourth from the same point, to proceed in a course southwardly, direct to Trenton.

The Mineral Spring which has been mentioned, has given much celebrity to the neighbouring region. It is said to have been known to the native Indians, and to have been employed by them as a remedy. The white people have resorted to it almost ever since the settlement of the country. Remarkable cures are ascribed to it. And some persons have been in the habit of visiting it season after season, for the purpose of being benefited by its wholesome properties.

It is situated in the town of Washington, in the county of Morris. It is, in strictness, a rill which issues from a fissure in the perpendicular side of one of the above-described rocks, on its eastern exposure. The place of discharge is, perhaps, between forty and fifty feet above the level of a brook which gurgles over the stones, and foams down the rocks in its channel beneath. The extremity of

a wooden leader, is so adapted to the crack in the rock as to receive the water, and convey it to the platform where the drinkers assemble ; and to the recesses, whither the bathers retire.

Its temperature is rather more than six degrees warmer than that of the spring-water near the summit. The mineral water, as it pours from the spout, possesses a heat somewhat warmer than fifty-six degrees. This is about the same which the slower springs and the shallower wells around New-York possess.

The quantity of water which it affords can easily be measured. By experiment, it appeared to discharge a gallon in about two minutes and a half. At this rate, the amount would be twenty-four gallons per hour. But allowance is to be made for leakage and waste ; inasmuch as the conduit does not collect the whole. Suppose this to be six gallons more. Then the quantity running out, will amount to thirty gallons per hour. Some trials are reported to have shown a rather more abundant flow. On the whole, it may be stated, with tolerable correctness, that the fountain within the bowels of the mountain emits, from this opening, a quantity of water, not varying greatly from a barrel per hour, or six hogsheads per day. The quantity is not observed to vary under any changes of season or weather.

The spouts which convey the water are lined with a yellowish deposit. The like sediment incrusts the reservoirs at the bathing house. The earth and stones through which the water soaks away, present a similar ochreous appearance. Where the boards contain astringent matter, a dark purple, or blackish colour is formed.

The presence of iron being thus indicated, a few experiments were made to determine the matter more clearly.

A bright blue was produced, on adding the prussiate of potash to the water.

Green leaves of the common chesnut-tree, (*fagus casta-*

nea,) on being bruised and infused in the water, formed a pale purple.

Those of chesnut-oak, (*quercus prinus monticola*,) yielded a brighter purple.

Those of the Sumach, (*rhus glabrum*,) quickly turned to a purple.

Fresh lacerated leaves of the maple, (*acer rubrum*,) immediately formed a deep purple.

Hickory leaves, (*juglans vulgaris*,) made a faint dusky hue.

Black-oak leaves, (*quercus nigra*,) struck a darker colour.

Butternut leaves, (*juglans cinerea*,) afforded a dusky brown.

The waters of the spring, mixed with brandy, made a mixture of a dark and unsightly colour.

An infusion of green tea, formed browns, purples, and blacks, according to its strength and proportion.

The chalybeate character of the water being thus established by so many tests, attempts were made to ascertain whether there was any gaseous impregnation.

For this purpose, glasses were inverted in a convenient vessel, receiving the stream immediately from the spout; but not a bubble of air was collected, other than common spring water affords.

To determine whether any carbonic acid was combined with the water in a form not spontaneously separable, lime-water was mixed with it; but no change of colour was perceptible in the mixture.

Various proportions of the spring-water and lime-water were mingled in repeated experiments, without effecting any cloudiness, or causing any precipitate.

Afterwards, as a test to the goodness of the lime-water, the milky hue and carbonic precipitate of the lime was instantly produced, by breathing through a tube into the mix-

tute of waters, air which had undergone the respiratory operation of the lungs.

There was thus no evidence of any carbonic acid at all.

When the water of the spring was suffered to stand in the open atmosphere, and acquire the summer temperature, by receiving twenty or more degrees of heat, some air bubbles were distinguishable on the sides of the vessel; but they were only such as any cold water would exhibit under equal circumstances.

As there was no calcarious incrustation at the spring, there was reason to believe the water destitute of lime. On adding to it oxalic acid, there was no change of colour produced. Whence it may be inferred, that lime makes no part of the constitution of this fluid.

To enable a judgment to be formed, whether any other earths were combined with the water, soda and potash were severally and repeatedly added. The precipitates were, however, so small, and so slowly produced, that there was ground to suppose the presence of earthy matter was very inconsiderable; and that there was no metallic impregnation, except that of iron.

The nitrate of silver caused a whitish appearance; but not in so inconsiderable a degree as it does in the water of New-York, constantly drank by the inhabitants. The cloudiness was, indeed, not more considerable than rain-water along the sea coast is occasionally known to present, when subjected to the same test. The tinge of muriatic acid hereby indicated, probably arises from a faint solution of sea-salt.

There is, notwithstanding, a weak acid of some kind in the Schooley's mountain mineral water. If litmus paper be exposed to the water as it issues from the rock, the blue is gradually changed to a reddish; and on the addition of an alkali, the acquired colour vanishes. What the nature of this inconsiderable portion of uncombined acid may be, is not perfectly easy to determine. Its presence is attended

with the flavour which water derives from running over decayed leaves, and draining through a soil abounding with the living and dead roots of trees, shrubs, and sylvatic plants. Former experiments have proved to me the existence of an acid in the rotten wood which overspreads the American forests. And water, passing through a stratum of vegetable mould, is known to receive what is called the *woody* taste. It is, therefore, presumable, that the rain-water receives a tincture from the thick layer of vegetable mould through which it is strained, and carries the flavour of it to the fountain. The peculiarities of this feeble acid, like that of numerous others we meet with in practice, does not seem to be defined in chemistry as yet, by discriminating characters.

The iron of this mineral water is very easily separated. Exposure to the atmosphere is followed by a metallic precipitation. Transportation to a distance, as bottles are commonly corked, is attended with a deposition of the iron. The water, after having been carried to New-York, when subjected to experiment in my house, gave no evidence of a chalybeate quality, when tested by the Prussian alkali and spirituous tincture of galls. This same water, after being boiled in a kettle, makes excellent tea. The heat of ebullition seems to separate the ferruginous ingredient; and the infusion is thereby freed from all dusky or black tint. Still, if this same infusion of green tea is mixed with water, fresh from the spring, a dark and disagreeable hue is instantly produced. A short exposure to the heat of  $212^{\circ}$ , thus converts this mineral water into good tea-water. It is employed for this purpose occasionally.

To valetudinarians and parties of pleasure, this region affords the double convenience of ascending from the level of tide-water to a desirable height, and of retiring from the maritime exposure to an interior region, by a short journey. Persons who wish an elevated residence, somewhat remote from the sea-coast, may be here exactly suited.

If there is any thing that deserves the name of a pure chalybeate water in the world, this would seem to be such a composition. The iron appears to be united with the water without the aid of carbonic, or indeed any other acid; for the weak acidity detected by litmus, can scarcely be considered as contributing to its solution. Some part of the iron ore, universally diffused among the minerals hereabout, is in a state proper for water to act upon, and to produce the martial impregnation remarkably free from other admixtures.

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XIV. *Mineralogical Notice respecting Fluete of Lime from Virginia. Communicated by BENJAMIN S. BARTON, M. D. Professor of Botany, Materia Medica, and Natural History, in the University of Pennsylvania, in a Letter to the Editor.*

SIR,

I SEND, along with this, a small specimen of Fluete of Lime, unquestionably the produce of our country.

This substance, so common in some parts of the old world, has recently been discovered in Virginia, in the county of Shenandoah. It is found, in considerable quantity, on the second great range of our mountains from the Atlantic, commonly called the "North Mountain;" and at the distance of a few miles from Woodstock, or Miller's-town, the county-town of Shenandoah.

I am not yet able to communicate to you all the information you might wish for, concerning the precise position, or locality, of this Virginia fluete. I am assured, however, that it occurs in loose, pebbly-like pieces, in the fissures between the limestone, which is the prevailing species of stone in the valley below; the great valley of Shenandoah, or Berkeley. In close connection with, or at least in the near vicinity of the fluete, is found abundance of a beautiful white carbonate of lime, with rhomboidal form.

The Shenandoah fluatite is not found on the top of the North Mountain, nor at the bottom, but "some distance up:" at what precise elevation I have not learned; but, probably, it is not great; for the limestone is seldom found high up the mountain, and never, I think, upon its summit.

The North Mountain is, unquestionably, one of our secondary mountains. The stones which compose it, are abundantly replete with the impressions of terebratules, and various other species of marine shells: and the neighbouring limestone, in the valley below, is also made up, in a very considerable degree, of the remains of marine animals. I shall not, therefore, be surprised to learn, that even the Virginia fluatite itself contains, occasionally, the vestiges of shells. Professor Kidd, I find, has examined an English specimen of fluor, with the distinct impression of a bivalve shell. *Outlines of Mineralogy*: vol. 1. p. 74. Oxford: 1809.

Considerable quantities of manganese exist at the distance of only a few miles from the place where the fluatite is found. And, if I do not greatly mistake, there is still another spot, nearer to the mine of manganese, where other portions of the fluatite occur.

P. S. The preceding was written before I had an opportunity of seeing the first Number of your *Journal*. Your work informs me, that the fluatite of lime has been found in other parts of the United States. But I think it has not yet been found in such abundance, in any of the places which you mention, as in Virginia.

XV. *On the Iron Works at Vergennes, Vermont, by Colonel GIBBS.*

IT affords great pleasure to an American traveller to observe the progress of manufactures in his own country. Amongst these the working of metals deservedly stands in

the highest class in point of variety and utility. These, for a long time restricted in their progress, have lately come forward to occupy our capitalists, and supply our wants.

Of the metals, not one is so valuable as iron. Without it, the plough would be neglected, and the soldier disarmed. But nature, always mindful of our wants, has distributed it liberally over the globe; and no country, perhaps, has more reason to be satisfied with its supply than the United States. Immense beds of magnetic iron ore extend, with little interruption, from Canada to the neighbourhood of New-York. The valuable brown hematite enriches many of our mountains, and the bog ore, in large quantities, is procured from our ponds and valleys. American industry has not left these neglected; but, with native ingenuity, has sometimes supplied the most pressing demands, and diminished, in times of difficulty, our dependence on foreign nations. But, unskilled in metallurgy, and as yet unprovided with large funds, their undertakings have been frequently unprofitable to the manufacturers, and, of course, been often abandoned. Most of our furnaces were erected in the early periods of the American war, when it became necessary to supply our armies with cannon; and the demand for some articles of great weight and rough construction has continued, a few of them, to the present period. There are now, I believe, about twelve in New-England.

The Bloomery forge, the most humble, and the oldest workshop of iron, has been of more general use. Where the waste of the combustible was of little consequence, and the ore fusible, it invited the small capitalist, and employed the farmer in the intervals of agricultural labours. But as capital and our wants increase, the Bloomery forge gives way to the improved furnace; and what was occasional occupation, becomes the most lucrative employment of a district, and the object of enterprise and capital.

One of the principal undertakings in New-England, is the establishment of the Iron Works at Vergennes, in Ver-

mont. The purchase of a bed of iron ore at Monckton, seven miles distant, led a company of gentlemen to erect, on the falls of Otter-Creek, the most extensive iron works to be found in the Northern States. Messrs. Welles, Perkins, Higginson, and Bradbury, of Boston, have engaged in this enterprise with a liberality, and to an extent which, I think, must ensure them success, and certainly entitles them to applause.

The works consist of a furnace, eight forges, an air-furnace, and a rolling and slitting-mill. The river is navigable ten miles for vessels of eighty tons burthen, from Lake Champlain to the falls; and the increasing population of this country, with the advantages of a market in Canada, render the manufactures of this district very important. The furnace is about twenty-eight feet high, nine in diameter at the bottom, and diminishing to two and a half feet at the top. This faulty construction, so common in the United States, brings the ore too soon into the crucible, and is productive of many evils; it being an established principle, in the construction of furnaces in Europe, that the sides should be as nearly straight as possible. Constructed as this furnace is, it only gives about two and a half tons of castings per day, though the best ores are at hand.

The other parts of this establishment are well worthy the attention of mechanics. Mr. Johnson, who constructed the machines, has combined simplicity, strength, and utility. The furnace and forges have each two cylinder bellows, by which they are supplied with air. By means of an arm, which serves as a regulator, the piston of the cylinder is preserved perpendicular, with a considerable diminution of friction. One of the forges is used for bloomed iron, and produces about fifteen hundred weight per week. The workmen are paid somewhat less than one cent per pound. The other forges, which are supplied with bar-iron from the forges on the lake, are employed in various manufactories of iron. Bar-iron sells here at about 140 dollars per ton.

The castings find a ready sale, though they have not yet attained the smoothness and lightness of those of Franconia.

The ores used at the furnace are, the bog-ore, which comes chiefly from the north end of the lake, and costs about 3 dollars per ton; the brown hematite of Monckton, at 3 dollars per ton; and the magnetic iron ore, chiefly from Coates's ore bed, on the west side of the lake, at  $4\frac{1}{2}$  dollars per ton. Charcoal costs on the spot  $4\frac{1}{2}$  dollars per hundred bushels; and there will be a sufficient supply for many years. A few miles distant, southward, there are strong indications of coal; so that it may be expected that when the supply of charcoal is exhausted, coal will continue the value of these establishments: It must not, however, be concealed, that there are some improvements necessary to render these works lucrative. The principal is the one before mentioned in the construction of the furnace; and for this purpose a master-workman should be sought in Europe. The great fault of most of our manufactories has been the employment of men without experience, or without the usage of the modern improvements. I know of none which have failed from any other cause. There is also a very considerable profit to be derived from the manufacture of steel at these works. The Monckton ore, which is a brown hematite, by a very simple process, may be converted into steel without any additional expence to the process of making bar-iron. This method is followed in Styria, and produces what is commonly called German steel. The spathose iron, and the brown hematite only, are susceptible of this treatment, and from thence derive additional value. To conclude, the iron-works of Vergennes promise to become as important as any in America, and offer every encouragement to the perseverance and enterprise of the proprietors.

**XVI. *On the improbability of finding Coal on Long-Island, or in the vicinity of New-York. By Dr. SAMUEL AKERLY.***

**T**HE high and increasing price of fire-wood in New-York, renders the subject of coal very important, when considered to be in the vicinity of this city. This desideratum has been so great, and is so well known, that it has been the ground-work of various deceptions, practised in different parts of the neighbouring country, for the sake of speculation. As far as relates to Long-Island I would venture to assert, that whoever has viewed it with a mineralogical eye, would pronounce that coal does not abound within it. We are led to look for coal in alluvial situations, or among the materials of the globe that have undergone changes since the creation, or even posterior to the deluge. Hence I would look for coal in the secondary regions in the north and western parts of this State, where bitumenous substances also prevail, particularly in the flötz, or flat rocks of Werner, in and about the falls of Niagara.

The slaty tract of country, so extensive in the State of New-York, is primitive, and cannot abound in coal. If coal should be found in the highland mountains of this State, I am induced to believe it would be in small quantities, and thin layers on the declivity of the hills, and in the bottom of the valleys, since it could only be formed from the small quantity of carbon deposited there from the decomposition of the primitive materials above, of which the mountains consist. The rocky and hilly county of West-Chester affords little or no indications of this substance. The island of New-York is partly a primitive granitical rock, and partly an alluvion of sand and stones. Coal must not be looked for here, since, to the depth of our deepest wells, nothing but siliceous sand, like that of our sea-shore, is thrown up.

Long-Island is likewise a body of sand of the same kind,

(except a small portion of granite about Hell-gate, in Newtown) having been deposited there posterior to the deluge, or as the waters retired from this great continent. Detached masses of granite are found in different parts of the island, but no otherways than in rocks. A ridge of sand-hills runs through the island, from west to east, on the north side, inclining to a direction between N. E. and S. W. parallel with the Fædish coast. In digging wells on these hills, oyster-shells have been brought up, from great depths, in various places. At the navy-yard, opposite this city, shells of the oyster, such as are at present found in the bay, have been dug out of the hill. It would hence appear that these sandy-hills have been suddenly formed upon the coast at a period since the deluge, perhaps by the bursting forth of the confines of some northern lake, which I shall endeavour to render probable in some future communication. The whole of Long-Island was not formed in this way, as, on the south of these hills, the country is uniformly flat, from one end to the other, a distance of 130 miles, having a gradual descent to the sea-shore, being nothing but sand and pebbles, which have been left by the further subsidence of the waters.

On the north side, several places have been pitched upon on account of the signs of coal, and pieces said to have been found. But this coal is nothing more than wood carbonated by sulphuric acid. There is a stratum of white clay running under the sandy hills of the north side of the island, in some places of which it is coloured with the brown oxyde of iron, and forms good red ochre, or Spanish brown. This vein may be traced from Muschito-cove, on the east side of Hempsted harbour, to Newtown, running nearly in a S. W. direction, and showing itself in the following places, viz. On the west side of Hempsted-harbour, opposite Muschito-cove; at Plandome, two miles further; again at the head of Cow-bay, another mile; again in a hollow, several miles further, in the same direction, near the head of Little-

Neck-bay, in Flushing; and, as lately discovered, in Newtown. Balls of iron pyrites are frequently found in this clay. By exposure to the air, they are decomposed, and the sulphuric acid unites with the iron and surrounding clay, and forms sulphate of alumine and iron, or alum and copperas. Whenever a piece of wood comes in contact during this process, it becomes blackened, or carbonated; and exhibits a deceptive appearance of coal; specimens of which I have collected on Cow-neck, similar to those from Newtown. Indeed, the same appearances have led some one, years ago, to search for coal on Cow-neck; and on the farm of Joseph Dodge are the remains of two shafts, sunk for the purpose of search, which turned out unsuccessful. Instead of sinking money in the search of coal, if a capital was invested in cleaning and preparing the coloured clay for market as a paint, there is a greater prospect of a favourable result. The red ochre on Mr. Dodge's farm lies on the shore of Cow-neck, above high-water mark, on the west side of Hempsted harbour, and is easily accessible.

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XVII. *On the Blue Earth of New-Jersey, by Mr. JAMES CUTBUSH.*

THIS mineral corresponds exactly with the blue iron earth of Werner, as described by Professor Jameson in his admirable Treatise on Mineralogy.\* The circumstance of its becoming blue on exposure to the air, after it has been taken out of the earth, as well as the other characters given

*\*External Characters.*

In its original repository it is said to be white, but afterwards becomes indigo blue, of different degrees of intensity, which sometimes passes into small blue.

Is usually friable, sometimes loose, and sometimes cohering.

Occurs massive, disseminated, and thinly coating.

Particles are dull and dusty.

Soils slightly.

Feels fine and meagre.

by Jameson, are sufficient proofs of its similarity with the blue iron earth of Werner. When first taken up it presents a yellowish-white appearance, and the change of colour is in proportion to the absorption of oxygen. Mr. Hemble explains this phenomenon upon a principle truly chemical, viz. That the iron, in its first state, is oxydized to the minimum, or in the state of protoxyde; but, on exposure, it becomes oxydized to the maximum, forming the peroxyde, during which the blue ray, according to some, is reflected; according to others, is absorbed. This fact, however, comes within the province of the optician.

This interesting mineral, I am informed, occurs in several places in New-Jersey. It was first discovered near Allentown, which is not far distant from Trenton, and exists in alluvial soil, sometimes accompanied with what, in Jersey, is called *Marl*. Whether this is the calcareous marl so generally esteemed in agriculture, I cannot determine; but I am inclined to believe that it is nothing more than *indurated clay*.

The nodules of the blue earth are generally accompanied with bog iron ore, which serves as a crust, and of course contains the *siderite*, according to all experiments I am acquainted with, which have been made on bog iron ore.

The blue earth has been used in the arts as a pigment, both with water and oil-colours, and is said to be durable. I am informed that a piece was tried by a coach-painter in Germantown, by grinding it with oil, and he found it *work better*, and was equal, in point of beauty, to the Prussian

Light passing into, not particularly heavy.

#### *Chemical Characters.*

Before the blow-pipe it immediately loses its blue colour, and becomes reddish-brown, and lastly melts into a brownish black-coloured slag, which is attracted by the magnet.

It communicates to glass of borax a brown colour, which at length becomes dark-yellow; dissolves rapidly in acids.

*Jameson's System of Mineralogy, vol. ii. p. 241.*

**Blue.** Beautiful greens and olives have been formed with it by mixing it with other colours.

With respect to its chemical composition I have only to observe, that from one or two general experiments I could not discover the least quantity of phosphoric acid, though it is generally considered, with us, as a phosphate of iron accompanying alumine and lime.

The experiment I made to discover the phosphoric acid was, (agreeably to the usual method) by digesting a portion in nitric acid, and throwing down the iron and earths from the solution by ammonia, and afterwards, on filtering it, adding to the clear liquor, in different glasses, nitrate of mercury, sulphate of iron, &c. Other gentlemen in Philadelphia have made several experiments without having discovered phosphoric acid.\* This fact, respecting the absence of phosphoric acid in the blue iron earth, is also mentioned by Jameson.†

**XVIII.** *Account of the production of the new metals, by the decomposition of Soda and Potash. Communicated by Professor SILLIMAN, in a letter to the Editor.*

YALE COLLEGE, AUG. 21, 1810.

DEAR SIR,

**A**S I have not seen any account of the repetition, in this country, of Professor Davy's experiments on the decomposition of the alkalies, &c. by galvanism, I take the liberty

\* Mr. Godon, I understand, however, has examined a piece of this earth, and found it to contain phosphoric acid. I would infer, therefore, according to the experiments I have stated, as well as others I have performed since, that this earth differs in composition. I have seen specimens in which the bog iron ore has penetrated the mass.

† Mineralogy, vol. ii. p. 342.

of mentioning the result of an attempt, which I have recently made, to decompose soda and potash.

My first trials were made with the only apparatus which we then possessed, consisting of one trough of fifty pairs of four-inch plates, and of two others, each of fifty pairs of plates two inches by one and a half. With this apparatus I had no expectations of success; and I was induced to make the attempt principally to satisfy myself that nothing could be effected by an apparatus of this extent. I used the common aqua fortis, diluted with from twenty to thirty parts of water; and, to save repetition, I will now mention that I employed this menstruum in all my experiments, and that, generally, the communication between the poles was established by iron wires, terminated by others of gold. I was agreeably surprised to find, that when this galvanic series was in active operation, there were *more than indications* of success. Both potash and soda, when placed in the galvanic circuit, exhibited a rapid effervescence, and metallic films appeared on the alkali, between the points of communication: they were transient, however, as there was not power enough to enable the metallic particles to collect into globules; but, occasionally, there were slight explosive combustions, with vivid light, jets of fire, and very caustic alkaline fumes. In a few instances, the alkaline mass which had been subjected to the galvanic action, exhibited a flash when thrown into water.

The success attending these trials, although only partial, was sufficient to induce me to prosecute the subject. The experiments which I have related, were not sufficiently striking to be exhibited before my class: they were performed in the presence of two or three companions. Those which I am next to mention, were executed at a public lecture, as well as previously in private.

I caused an apparatus to be constructed of one hundred and fifty pairs of plates, of copper and zinc, of six inches diameter: they were not soldered together, but were con-

nected by straps of sheet-lead, the ends of which were soldered to the plates so as to form a perfect connection. They were then arranged in troughs, divided into compartments by parallel plates of crown glass, (common window-glass) cemented in grooves, precisely as the metallic plates usually are in the common galvanic troughs. The pairs of plates were then arranged in the cells, exactly in the manner of the *couronne des tasses* of volta, of which this apparatus is, indeed, only a revival in an improved form. In constructing it, I availed myself of the information contained in Mr. Children's paper in Nicholson's Journal, and of hints from other sources. The superiority of this construction is evident: it exposes twice the quantity of surface to the action of the chemical menstruum, and is therefore, weight for weight, much more powerful than the apparatus in common use: the insulation of the cells is much more complete: it is cleaned with the greatest ease, as the pairs of plates are all moveable; and, for the same reason, it is much more portable: Lastly, the troughs are not liable to injury from the acid following the plate into the cement, and thus causing the cells to communicate with one another.

With this apparatus, even with twenty-nine parts of water to one of acid, I was able to succeed without difficulty, especially when the trough, of fifty pairs of four-inch plates, was added to the series. The decomposition was then rapid and evident, and the phenomena were most striking in the case of soda: alkali was placed upon an insulated platinum-support: when the communication was formed, there was a production of intense light: an abundant effervescence and brilliant metallic globules rose through the fused alkali, many of which burnt spontaneously, or rather exploded, with bright flashes, darting out jets of fire so far that goggles were necessary to save the eyes from injury: the combustion produced, in every instance, white alkaline fumes, so very caustic that the glass which protected the eye, (which, for the sake of more distinct vision, was placed

near the point of agency,) was soon corroded, and rendered so opaque that it intercepted the sight, and the face was painfully affected where it was not covered; a sufficient proof how necessary it is to guard the eyes in these experiments, both from actual burning, and from corrosion by the regenerated alkali. When globules of the metal were thrown upon cold water, they floated, and appeared like quicksilver; ran actively over the surface of the fluid like summer insects, and soon burnt with a bright flame like phosphorus, and were dissipated in alkaline fumes.

Portions of the metals, when suffered to remain exposed to the air, soon became tarnished and white, and it was found difficult to preserve them long, even under the transparent inflammable fluid distilled, from petroleum. In short, all the facts which I observed, perfectly corresponded with the statements of Professor Davy, although his splendid discovery of the decomposition of the alkalis needs neither illustration nor proof. The phenomena produced by potash, were less striking than those exhibited by soda, but still were satisfactory, and so perfectly of the same kind that it is not necessary to repeat them particularly.

I have not yet had leisure to repeat the experiments on the earths and primary inflammables: I hope to do it ere long; and, if necessary, with an apparatus still farther augmented. I will merely mention now, that when the galvanic fluid was passed through strontites, mixed with red oxyd of mercury, a decomposition of the earth was indicated by the production of a bright-red flame, such as that exhibited by a crystal of nitrat of strontites placed in the wick of a candle.

I have repeated many of the experiments mentioned in Mr. Davy's first Bakerian lecture, with respect to the decomposition of saline, and other compound bodies, and their transference to a distance, *even into different vessels, and through attracting media*, and always with satisfaction; and not without admiration at the wonderful divellent pow-

ers of galvanic electricity, and the sagacity and address which has developed a series of facts, in the highest degree interesting and important.

I cannot conclude without remarking, that after a careful consideration of the new discoveries, by the aid of galvanism, they appear to me very happy additions to the proofs of the truth of the modern theory of combustion, which embraces almost every thing that is properly called the modern chemistry; and I can see no reason for resuscitating the doctrine of phlogiston. No satisfactory proof has yet been exhibited that phlogiston (or hydrogen) enters into the composition of any metal: and although its presence should be established (according to the experiments of Mr. Davy) in sulphur and phosphorus, it will not, in the least, invalidate the received theory of combustion. Nay more; should it be found that hydrogen enters into the composition of every metal, and of every combustible, still the present theory of combustion would remain unshaken. It stands upon this magnificent fact, that *in every case of combustion oxygen combines with the burning body, and both changes its nature and increases its weight*; a fact, which the doctrine of phlogiston never contemplated, and without which, combustion cannot exist; nor is it of the least consequence what the nature of the combustible matter is; whether combustibles consist of many principles, of but few, or of only one: in short, whether hydrogen, (or any thing else which it is convenient to call phlogiston,) exist in most combustibles, or in all, or even whether there be any other ultimate combustible matter, still *oxygen is the agent of combustion, and must, under every change of chemical theory, ever remain so*. This dispute is therefore useless. The doctrine of phlogiston, as it was believed and taught by Boeher and Stahl, and their followers, is perfectly lame. It is not easy to see why any one should wish to revive a creature of the imagination, which, after all, must be dressed out in a costume

composed of the tatters of the ancient, interlaced with the splendid robes of the modern chemistry.

Our theories should never be dearer than truth ; but it is certainly unwise to endeavour to adapt a theory, which was formed when the most important *fundamental truth was totally unknown*, to a state of science, when our theory is very little more than a simple declaration of fact.

I am, Sir, with great respect,  
Your most obedient servant,

B. SILLIMAN.

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XVIII. *Mineralogical Notice respecting Elastic Marble, from Massachusetts. By W. MEADE, M. D.*

HAVING been on a mineralogical excursion, through some of the Eastern States, among other fossils of an interesting nature, which I had collected, I was fortunate enough to have met with fine specimens of Elastic Marble, differing in many respects from the description which is given of it by any mineralogical writers.

The quarry from which this marble is taken, is situated near Pittsfield, in the State of Massachusetts, where a considerable quantity of it is manufactured for various purposes ; such as chimney-jams, grave-stones, &c. &c. On taking up one of those stones, which was just prepared for an inscription, I was much surprised at the tremulous motion which I perceived, and at first feared that it would have fallen to pieces before I could replace it. However, on examining it with more attention, I found that it was completely elastic ; that it bent on the least motion, but recovered itself without the smallest change or crack appearing in any part of it.

Out of a number of stones of the same species of marble, which were then finished in the yard, only two possessed this quality. These were about four feet high, and near

two feet wide, and the elasticity of these was so remarkable as to excite considerable surprise on first handling them. I examined a number of them, and confess that I could see no difference in the structure between those that were elastic and those that were not so. The workmen informed me that they often met with it possessing this quality, but they could not, from any external appearance, distinguish the difference.

This marble resembles, in colour and external characters, that which is found in such abundance at Chesnut-hill, in Pennsylvania: its colour is greyish-white; its fracture foliated; structure granular, but not fine grained; so little so as certainly not to be classed with the dolomite, nor is it phosphorescent; it is not easily frangible, and effervesces violently with acids.

It occurs in the neighbourhood of gneiss, quartz, chlorite, and chlorite slate, passing into mica slate and clay slate.

Elastic marble, though mentioned by some late writers, is certainly a fossil of rare occurrence, and has been found but in few places in Europe. I know not that it has ever been discovered in Britain. Jameson mentions that Fluvian de Belvue has discovered varieties of granular limestone that possessed this quality; but he does not describe them. Dolomieu says, that some granular lime-stones, if sawn into thin pieces and heated, become elastic; which he attributes to the evaporation of the moisture contained in them. This marble he only found at Mount St. Gothard, and says that it was a dolomite, and that no other marble could be made to produce the same effect. Belvue's observations are said to confirm these, and to prove, *first*, that no marbles have this quality but the real fine grained dolomites; and, *secondly*, that the elasticity depends altogether upon the effect of heat, and the consequent loss of its water of crystallization.

It is not possible, perhaps, to have these opinions more

fully refuted than in the case of this fossil, which can be found in abundance at Pittsfield, and appears to be a singular variety of marble, possessing in a high degree the power of elasticity immediately after it is cut from the quarry, and without the application of heat, or any other artificial cause; so that the explanation of the fact, it appears to me, must be sought for in some peculiar structure of the stone, or in some singular arrangement of the particles of it, during the progress of its crystallization.

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XX. *Account of the remains of Marine Animals in a fossil state, in New-Jersey. Communicated by the Honourable Dr. MITCHILL.*

**A**N extensive layer of marine exuvie has been discovered in Monmouth county, New-Jersey. It exists to the westward and southward of Sandy-Hook. It has been observed to extend about a mile along the shore of Raritan Bay. The bank is composed of these animal remains, the following specimens of which I have received through the politeness of Thomas Phœnix, Esq. of this city.

1. Large and thick *oyster-shells*, of a singular figure, and differing, in some respects, from those now found along the coast.

2. *Cockle-shells*, different from those now extant thereabout, in a living state: these are fluted like the Scallop, but are thicker, and of another shape.

3. *Calcareous marle*, produced evidently from the decayed shells: This is of an ash-colour. It forms the bed in which the shells repose. It effervesces briskly with vinegar and the stronger acids. It constitutes the great mass of the stratum, through which the shells are dispersed.

4. *Belemnites*, These are from two to four inches long, semi-transparent, crystallized in radii from the centre to the circumference, and excavated at one end like a horn.

5. *A bone, with a tooth.* This osseous substance seems to be part of the jaw of the spermaceti whale. The enamel or ivory of the tooth, is blackened. The tooth appears to be rather an excrescence or projection of the maxillary bone, than a distinct body inserted into it by gomphysis. But the organic structure, both of the tooth and jaw, are plainly distinguishable.

It is said, that various other remains of marine animals have been discovered in this vast deposit of calcareous matter.

This mass of animal remains is believed to underlay the Neversink-Hills, and to extend quite to Middletown, and the vicinity of Shrewsbury River.

To the geologist, this discovery affords a theme for interesting reflections. This collection of oceanic relics lies within the alluvial region of North America, and evinces, by the most cogent and unequivocal evidence, the formation of dry land by the dereliction of the sea. To the cultivator of the soil, it is no less important. Experience has shown it to be an excellent manure. Farmers who have tried it, have celebrated it as nearly equal to ashes, in its fertilizing operation; and its contiguity to water-carriage allows it to be transported to any plantation along the shores, at a moderate expense.

XXI. *Description, and Chemical Examination of an ORE of ZINC, from New-Jersey. By the EDITOR.*

RED OXIDE OF ZINC.

*External Characters.*

COLOUR, light and dark red, approaching to blood red, ruby and aurora red.

Opaque, though generally translucent on the edges.

Fracture foliated—cross fracture slightly conchoidal.

Lustre on fresh fracture, shining : after long exposure to the atmosphere, dull : the surface in time becoming covered with a pearl white crust.

Brittle—being easily pulverised, the powder, brownish yellow, approaching to orange.

Readily scratched by steel.

Specific gravity, 6.22.

#### *Chemical Characters,*

Soluble in the mineral acids.

Infusible before the blow-pipe per se. With Sub-Borate of soda, melts into a transparent yellow bead. When exposed to the united flames of oxygene and hydrogen,\* it sublimes, attended with a brilliant white light.

When powdered, and with potash exposed to heat, it fuses into an emerald green mass, which on solution, affords to water the same colour. On the addition of a few drops of nitric, sulphuric or muriatic acids, the green coloured fluid is immediately changed to a rose red.

#### *Distinguishing Characters.*

Its infusibility distinguishes it from the *red antimoniated sulphuret of silver*, which is fusible before the blow-pipe, giving out white fumes, and a yellow tinge to the charcoal, leaving a globule of reduced silver.

From the *ruby red oxide of copper*, it differs in weight, being nearly twice as heavy, its specific gravity being only

\* For the application of hydrogen and oxygen gases, to the purposes of the blow-pipe, we are indebted to Robert Hare, Jun. Esq. Professor of Natural Philosophy in the University of Pennsylvania. For a description of his hydrostatic blow-pipe, we refer the reader to a pamphlet published in 1802, by order of the Chemical Society of Philadelphia; and also to a paper of his, read before the American Philosophical Society, in June, 1803, and published in the fifth volume of their Transactions.

3.9. It is also distinguished by its solution in acids, being colourless; whereas that of the red oxide of copper is of a bright green. Its solubility in the mineral acids is sufficient to distinguish it from the *red oxide of titanium*, which is insoluble. The *red chromate of lead*, before the blow-pipe, melts into a blackish slag. The *red sulphuret of arsenic* is volatilized, giving a blue flame, and a strong smell of garlic.

#### *Locality.*

This mineral occurs in several of the iron mines in Sussex county, New-Jersey; as at the Franklin, Stirling, and Rutgers mines, and near Sparta. In some instances, it is imbedded in a sparry lime stone; while in others, it serves as the matrix of several varieties of octahedral oxide of iron, which sometimes occurs crystallized, though more generally in various sized irregular grains.

At Franklin, it also assumes a micaceous form, and is imbedded in a whitish oxide of zinc, which is often, in the same specimen, found adhering to the black oxide of iron.

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Having ascertained by previous experiments, that this mineral was principally composed of oxide of zinc, iron and manganese, it was submitted to the following

#### *Chemical Examination.*

A. Twenty-five grains of the ore, in fine powder, were dissolved in diluted nitric acid: the solution was colourless.

B. To the solution A, was added oxalic acid, while any precipitation took place. The precipitate (oxalate of zinc) being separated by the filter and dried, weighed 42 grains.

C. The filtered fluid being evaporated to dryness, a dark brown coloured mass remained, which after being ignited, weighed two grains.

D. The brown coloured mass C, being dissolved in diluted muriatic acid, into the solution was dropped a solution

of super-tartrate of potash. After standing a few minutes, the solution became turbid, and a precipitation of minute crystalline grains (tartrate of manganese) took place. To the remaining fluid was added Prussiate of potash, which produced a dark blue colour; and after a few minutes a blue powder (Prussiate of iron) was precipitated.

E. The oxalate of zinc, B, (consisting of 23 grains oxide of zinc, and 19 of oxalic acid) was exposed to a low red heat (in a platina crucible) for ten minutes, when the powder was changed to a light yellow colour. On further ignition, for half an hour, the colour became darker, and the powder on being weighed was found to have lost 20 grains, the remaining 22 grains being a sub-oxide of zinc, which according to the experiments of Desormes and Clements, contains in the hundred parts 88 of zinc, and 12 of oxigene.

According to this examination, one hundred parts of the ore contain

Zinc	76
Oxigene	16
Oxides of Manganese and Iron	8
	<hr/>
	100

#### NOTE.

The recently discovered property of the malleability of Zinc, at a temperature of 300° of Farenheit, has greatly enhanced its value, and raised it to a high rank among the useful metals. The inconvenience arising from its brittleness, being removed, this metal is now applied to many of the purposes for which copper has hitherto been used.

As the demand for metallic zinc must necessarily increase as its application to the arts becomes more general, the mineral just described will prove a source from which this metal may be procured in abundance, and a series of experiments sufficiently shew the ease with which it may be separated from the ore.

In the manufacture of Brass, this ore possesses advanta-

ges over those generally used ; as without previous preparation of ustulation, &c. it affords with copper a compound possessing a high degree of malleability, a fine colour and every requisite of the best kind of brass, such as is used in the finest and most delicate workmanship, equal in every respect to that made from the reduced metal or (as it is more generally termed) Spelter, which being imported, bears an exorbitant price.

This mineral may also be advantageously employed in the manufacture of the sulphate of zinc, or white vitriol of commerce. Experiments also prove that the oxide or flowers of zinc, may, without much difficulty, be obtained from this ore. The oxide of zinc has of late been recommended as a substitute for whitelead as a pigment, over which it possesses some advantages, as it is not so liable to change, and in its preparation is not subject to those deleterious consequences so frequently attendant on all the preparations of lead.

This red oxide of zinc from its abundance, and the many uses to which it may be applied, promises to be a valuable acquisition to the manufacturing interest of the United States,

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## PUBLICATIONS.

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*Description of a Cave on Crooked Creek, with remarks and observations on Nitre and Gun-powder, by SAMUEL BROWN, M. D. of Lexington, Kentucky.* [Transactions of the American Philosophical Society. Vol. VI.]

**T**HERE are few works on Natural History or Chemistry which do not contain some facts or opinions concerning the formation and properties of nitre. To recapitulate these facts, or to state the various theories to which they have given rise, would be a task very different from that which I have undertaken ; which is merely to communicate a short account of some of the most remarkable caverns and rocks from which that salt is obtained in Kentucky ; and to offer

some conjectures relative to the causes of the imperfection of the gun-powder manufactured in the United States.

The quality of the nitre procured from the earth in calcareous caverns, is universally believed to be different from that which is found in the sand rocks. I have not been able to ascertain, with any degree of precision, the quantity annually manufactured in this state, nor the number of caverns which are known to contain it. I have, however, visited several of the most remarkable of them, and from the best information I could procure, I have formed the following estimate :

The great cave on Crooked Creek,	lb. of Nitre.
a branch of Rock Castle, supposed to contain	.....1000000
Scott's cave, two miles distant from the great	
cave, .....	200000
Davis's cave, six miles distant from the great cave,	50000
Two other caves, within a mile of the great cave,	20000
A cave on Rough Creek, a branch of Green River,	10000

Besides these, which I have had an opportunity of examining, I have heard of many others in various parts of the state: some of which are esteemed very rich in nitre, and are said to be of great extent.

The great cave on Crooked Creek, in Madison county, is situated about 60 miles south-east of Lexington. It has two mouths, which are 646 yards distant from each other, and about 150 yards from a large creek, which winds round the hill through which the cave affords a commodious passage for horses and waggons. The general level of the floor of the cave is 80 feet above the creek. The average height of the arch is ten feet, though in many places it rises to fifty or sixty. The breadth of the passage is generally about forty feet, in some parts it is seventy or eighty feet. The floor has the appearance of a large public road, which has been much frequented. The ceiling is, in most places, smooth, with but few incrustations or stalactites. In some of the chambers, however, there are appearances of Gothic

rudeness and irregularity, which are truly sublime. When these vast chambers are sufficiently illuminated by the torches and lamps of the workmen, they present scenes so uncommon and so romantic, that the most stupid beholder cannot contemplate them without expressions of the greatest astonishment. During the winter season, the effect of these scenes is greatly increased by a stream of water which, issuing from a small opening in the arch of the cave, about twenty feet above the floor, and falling into a basin, occasions a noise which, in these calm regions, can be heard at a great distance, and echoing from arch to arch, fills the mind with the idea of some mighty cataract.\*

The temperature of this cave, during the last winter, (the coldest we have had for several years) was generally 52° of F. sometimes the mercury rose as high as 57°, but never sunk to the freezing point, when the thermometer was placed at any considerable distance within the cave. In one chamber, however, the heat was frequently so great as to be disagreeable. About sixty paces from the south entrance, a passage leading from the main avenue conducts you to this chamber, which is nearly circular, and about twenty feet in diameter. The arch over this part of the main avenue, and that over the passage leading to the warm chamber, are equally elevated; but the ceiling of the chamber is twenty or thirty feet higher. As you approach the cham-

\* This cave was discovered about seven years ago by a Mr. Baker. He entered it by the north mouth, but proceeded only a small distance into it, on the succeeding day he brought his wife and two or three of their children to explore it, he carried a torch and his wife a supply of pine. After they had advanced within hearing of this torrent 400 or 500 yards from the north mouth, the only one then known, he dropped his torch and it was completely extinguished. During two days and two nights this miserable family wandered in total darkness, without provisions and without water, though sometimes within hearing of a cataract which they durst not approach. At length Mrs. Baker in attempting to support herself on a rock, perceived that it was wet, she conjectured that this was caused by the mud which they had brought in on their feet. Baker immediately ascended the rock, and saw the light of day.

ber, the floor gradually rises until it ascends above the level of the arch of the passage. As soon as you ascend above that level, you perceive the air uncommonly warm, even when the temperature of the passage is near the freezing point. The air which fills the main avenue in summer and autumn is forced into this chamber, whenever the external atmospheric air becomes so much condensed by cold as to rush into the mouth of the cave; and whenever, during the winter, any portion of air in the main avenue, where the passage leads off, is accidentally heated by fires, or by carrying torches or lamps through the cave, as this heated air cannot escape by the mouth of the cave (for the arch descends towards the mouth) it ascends into this chamber, and rises to the ceiling, where it must remain until the external air, and that in the passage and avenue, acquire a higher temperature than the air in the chamber. This chamber then is constructed precisely upon the principles of the Russian vapour-bath, so minutely described by count Rumford.

During the winter season, the walls and floor of this cave remain perfectly dry; but in summer innumerable drops of water collect upon the rocks, and trickle down upon the floor, which sometimes becomes as moist as a bed of mortar. This is particularly the case, during very hot weather, when the atmosphere is loaded with vapours. I collected a quantity of the liquid condensed upon the rocks, and found that it possessed the same properties with the liquor obtained by lixiviating the earth on the floor of the cave. It would appear from this fact, that the nitric acid is formed in the cave, and is condensed upon the rocks, the lime of which it dissolves. But in what manner this nitric acid is formed, I confess myself wholly ignorant, as there are no substances in a state of putrefaction, within the cave, which could yield the requisite supply of nitrogene gas. It is to be remarked, that the whole of the water condensed upon the rocks, does not taste of the nitrate of lime. A great

part of it is quite insipid, although dropping upon earth which is rich in nitre; and many parts of the cavern have been found so completely filled with clay, that it is not easy to conjecture how it was possible for atmospheric air to reach them; and this clay too is strongly impregnated with nitrate of lime. The depth of the earth on the floor of this cave has never yet been ascertained. In some places the workmen have dug down fifteen feet, and the earth, even at that depth, still contains nitre. It is commonly supposed that, throughout the cave, every bushel of earth contains at least one pound of nitre. In many places it will yield more than two pounds to the bushel. Formerly the earth was taken out of the cave and lixiviated near the stream; at present hoppers are erected in the cave, and the earth, after lixiviation, is left to be impregnated again with nitrate of lime; but what length of time will be requisite to saturate it, has not yet been ascertained.

The workmen have different modes of forming an opinion with regard to the quantity of nitre with which the earth may be impregnated. They generally trust to their taste; but it is always considered as a proof of the presence of nitre, when the impression made on the dust by the hand or foot, is in a very short time effaced. Where the nitre is very abundant, the impression made to-day will be scarcely visible to-morrow. Where there is a great deal of sand mixed with the dust, it is commonly believed that a small quantity of potash will suffice for the saturation of the acid.

The method of making saltpetre, usually practised in Kentucky, is as follows:

The earth is dug and carried to hoppers of a very simple construction, which contain about fifty bushels, cold water is poured on it from time to time, and in a day or two a solution of the salts runs into troughs placed beneath the hoppers. The lixiviation is continued as long as any strength remains in the earth. The liquor is then put into iron kettles, and heated to ebullition; it is afterwards thrown

upon a hopper containing wood-ashes, through which it is suffered to filtrate. As the alkaline part of the ashes is discharged before the nitrate passes through, the first runnings of this hopper are thrown back; and after some time, the clear solution of nitrate of potash runs out, mixed with a white curd, which settles at the bottom of the trough. This clear liquor is boiled to the point of crystallization, then settled for a short time and put into troughs to crystallize, where it remains twenty-four hours; the crystals are then taken out, and the mother-water thrown upon the ash-hopper, with the next running of the nitrate of lime. When the quantity of the nitrate of lime is too great for the portion of ashes employed, the workmen say their saltpetre is in the "*grease*," and that they do not obtain a due quantity of nitre. If there has been too great a proportion of ashes employed, they say it is in the "*ley*," and when it is left to settle previous to crystallization, a large quantity of salt will be deposited in the settling troughs, which they call "*cubic salts*." These salts are again thrown upon the ash-hoppers, and are supposed to assist in precipitating the lime from the nitrate of lime, and, in the opinion of the workmen, are changed into pure saltpetre. They consider this salt as nitre *killed*, as they express it, by the excessive strength of the ley. To make 100 pounds of good saltpetre at the great cave, eighteen bushels of oak ashes are necessary; ten of elm, or two of ashes made by burning the dry wood in hollow trees. In the discovery of the value of this latter kind of ashes, the philosophers and chemists of Europe have been anticipated by the saltpetre-makers of Kentucky.\* The earth in some caves does not require half this quantity of ashes to precipitate the impure salts.

When wood-ashes cannot be readily obtained near the caves, the liquor which runs from the earth in the hoppers is boiled down to the point of crystallization, and suffered to

\* See vol. X. p. 330. Philosophical Magazine.

become solid by cooling. In this form, which is called "*thick stuff*," it is transported to a part of the country where ashes can be procured, dissolved in ley sufficiently strong to precipitate the lime, settled in troughs, and then boiled down and crystallized. This thick stuff is extremely liable to deliquesce in warm moist weather, and is therefore commonly melted down, and put into casks before it is carried from the caves. Horned cattle are very fond of it, and a small portion of it is almost instantly fatal to them. Those who have had frequent opportunities of seeing cattle perish in this way, remark that the blood, when drawn from their veins, is of a very black colour, and flows with great difficulty. A substance possessing such active properties, might deserve the attention of experimental physicians, and may possibly merit a share of that praise which has been so liberally, and perhaps so injudiciously bestowed upon the nitrate of potash.

After these observations on the calcareous nitre-beds in Kentucky, and the modes commonly employed for obtaining that salt, I shall mention some of the most remarkable circumstances which have come to my knowledge, relative to the rock ore, or sand rocks, which yield nitre supposed to possess peculiar qualities.

These sand rocks are generally situated at the head of a ravine or narrow valley, leading up a steep hill or mountain; ascending the streamlets which run through these valleys, the banks close in upon you and become perpendicular. The rocks are frequently from sixty to one hundred feet in height, and jutting over their bases, which rest on a calcareous stratum, often forming a shelter large enough to secure a thousand men from the inclemencies of the weather. During the winter season a small rill is precipitated from the top of these rocks, and in summer, water generally issues from between the silicious and calcareous strata. These sand rocks, which probably once formed a complete upper stratum, have been for ages exposed to the destructive ope-

rations of rains and frosts, and as they crumble off, are carried by torrents into the plains and rivers beneath. The summits of all the hills in the vicinity of Rock-castle, Licking and Sandy, are still covered by masses of these rocks, which, from their beauty and variety of figure, might, at a small distance, be mistaken for the ruins of Gothic cathedrals, or Baronial castles. Vast blocks of them have rolled down into the valleys, at a period of time so remote that they are now covered by trees of a luxuriant growth. These rocks, when broken perpendicularly, present a surface consisting of strata so irregular, with regard to their position, and so different in colour, and in the size of the particles of sand, that it is impossible to doubt of their Neptunian origin. The minute inspection of them never fails of awakening in the mind the recollection of the shore of some vast lake, where the rage of the winds and the waves has piled up hills of sand, which time consolidates into rock.

Several years ago the saltpetre-makers discovered that the sand and rubbish sheltered from rains by these rocks, contained a rich impregnation of nitre, and that only a small portion of ashes was necessary for its purification. They soon after found that the sand rock itself tasted strongly of saltpetre, and immediately commenced the new method of working.

After blowing off large blocks of the rock, they break them into small pieces with hammers, and throw them into kettles containing boiling water: as soon as the rock falls into sand by the action of the hot water upon it, they put it into hoppers and wash out all the nitre by frequent additions of cold water; this solution is boiled down and crystallized without any mixture of ashes or potash. Sometimes, when the mother-water has been very often added to fresh solutions of the nitre, they find it necessary to use a very small quantity of ashes.

I have been informed by a Mr. Fowler, that he and his associates have made saltpetre at twenty-eight different

rock-houses or caverns, from which they have obtained about 100000 lbs. of nitre ; all these are situated on the north side of Kentucky river, within seventy miles of Lexington. He remarks that he has never seen a rock facing the north or west, which was very rich in nitre. He has always desisted from working a rock when it failed to yield him ten pounds to the bushel of sand. He has often obtained twenty or thirty pounds per bushel. He assured me that he once discovered a mass of very pure nitre, which was found to weigh 1600 pounds. Mr. Foley, another saltpetre-maker, found one containing 100 pounds : another mass was found on Rock castle, which report says weighed 500 pounds. I have now in my possession a solid mass of native nitrate of potash of singular purity, which weighs three pounds ; it is more than four inches in thickness, and is only a small portion of a block of nitre found last summer on Licking River : I have likewise a number of smaller specimens, which I, myself, procured from the different caves which I visited some weeks ago. These are generally found between the rocks which have fallen from the cliff, or the crevices of those rocks which still remain in their primitive situation. The rocks which contain the greatest quantity of nitre are extremely difficult to bore, and are generally tinged with a brownish or yellow ocre colour. Sometimes they contain an oxyde like manganese, and sometimes great quantities of iron ore, which resembles the bark of the scaly-bark hickory, surrounded by a finely powdered brown oxyde. At some of these rock-houses three hands can make one hundred pounds of good nitre daily, but forty pounds may be considered as the average product of the labour of three men at those works which I had an opportunity of visiting.

The workmen being badly provided with tools and apparatus, desert a rock whenever its size or hardness renders it difficult for them to manage it, and go in quest of a new establishment. Several caves and rocks which these strolling chemists have deserted, still contain many thousand

pounds of nitre. These men are continually searching for masses of pure nitre, or rich veins of ore, by which much of their time is unprofitably dissipated. Still however most of our saltpetre-makers find it their interest to work the sand rock rather than the calcareous caverns, which last yield a mixture of nitrate of potash and nitrate of lime. The rock saltpetre is greatly preferred by our merchants and powder-makers, and commands a higher price.

Mr. Barrow, in his travels through the southern parts of the continent of Africa, discovered native nitre, which is probably similar to the rock saltpetre of Kentucky. But Bowles, Dillon and Townshend assure us that those districts in Spain, which afford nitre most abundantly, contain neither chalk, limestone, gypsum, nor any other calcareous substance. The nitrate of potash is obtained there by filtrating a certain kind of black mould which will continue for ages to yield annual supplies of it, together with muriate of soda, sulphate of magnesia, nitrate and sulphate of lime. Here then appears to be such a relation existing between the different saline substances, both acids and alkalies, that the causes which produce one of them, owing to some yet undiscovered circumstance, regularly produce all the rest. According to these authors the same mould will continue forever to yield these salts annually. This observation if correct, would induce us to believe, that both acids and alkalies are wholly formed from atmospheric air and not from the soil; as the soil would certainly be exhausted if any considerable portion of it entered into the composition of either the acids or alkalies, and would soon lose its power of attracting from the air the other constituent principles of the salts. Both in Spain and India, we are informed, that the mould which for fifty years in succession has yielded nitre, still continues to afford it in undiminished quantities. But how shall we reconcile this fact with that before related concerning the production of nitre in the cavities of calcareous mountains which are, in many instances, so closely filled up with clay,

that the air can have no access, from which every ray of solar light is excluded; and where the temperature can never exceed 57° of Fahrenheit? Is it absolutely certain, that nitre formed by natural processes so very dissimilar, possesses no properties necessarily resulting from the circumstances attendant on its formation? That all the nitrates of potash with which we are acquainted, have certain properties in which they agree, is unquestionable, but the same may be said of lime and barytes, of soda and potash, and many other substances, which in the early ages of chemical science, were probably identified. Hoffman, long ago proved, that nitrate of potash afforded an alkali very different from that of wood ashes or salt of tartar. The observations of so distinguished a philosopher deserve much attention, and his experiments if repeated by modern chemists could scarcely fail of affording important results: that the sand rock saltpetre differs from that procured from the calcareous caverns, in the form of the crystal, in hardness and dryness, is known to all who deal in that article, and every powder-maker affirms that it makes better gunpowder. Whether this superiority is owing merely to its greater purity or exemption from an admixture of nitrate of lime, or whether the constituent acid and alkali are modified in some unknown manner, is yet altogether problematical. Chaptal, Thouverel, Guyton, and indeed most of the modern chemists, suppose, that potash is a compound of lime and hydrogen, and that lime itself is formed of carbon, azote and hydrogen, and consequently that potash consists of hydrogen, carbon and azote. Mr. Guyton thinks that soda is composed of magnesia and hydrogen, and that magnesia is a compound of lime and azote, and therefore, that soda is made up of hydrogen, carbon and azote. He is then of opinion that potash, soda, lime and magnesia are nothing more than varied forms and proportions of the same constituent ingredients, differing from each other in the quantities and forces of attraction. This opinion derives great probability

from an experiment of Bishop Watson, by which it would appear, that soda was actually converted into potash. It is likewise corroborated by the apparent conversion of lime and soda into potash in our calcareous caverns, and by the change of what the workmen call *cubic salts*, into nitrate of potash. Thouverel affirms that he witnessed the real conversion of washed chalk into potash, in his experiments on nitrous vapours, and Chaptal observed the same phenomenon when exposing chalk to the vapours of putrid bullock's blood. Now as the nitric acid combines readily with lime, soda and magnesia, as well as with potash, it may be easily conceived, that it still retains its affinity for those substances, in every form which they may assume, whilst changing into each other, and that the "*tertium quid*" formed by the union of nitric acid and lime in the intermediate stage between lime and potash, may possess properties very different from nitrate of lime or nitrate of potash. The same may be remarked with regard to soda and magnesia. Here every chemist will recollect the ingenious observations of Dr. Mitchill, concerning nitric acid and the essential differences between that substance and septic acid at the moment of its formation. No person can doubt of the possibility of charging nitrogen with different portions of oxygen. The explosive efficient property of nitre may depend on a certain dose of this principle. But even admitting that potash and nitric acid never vary in their nature, it may still be contended, that powder-makers have no means of ascertaining what proportion of acid and alkali that nitre ought to contain, which would form the best gunpowder. And whilst this is confessed, it surely can avail us little, to be very scrupulous in the adjustment of the proportions of the nitre to the charcoal and sulphur. The consumers of potash, in every part of the world have remarked varieties in the quality of the salt, for which no particular cause can be assigned. It is very much to be regretted, that a regular series of experiments has never been instituted, to discover what kind of ashes would yield

an alkali most proper for the formation of nitre. Charcoal should be examined with a similar view. Mr. Coleman has published experiments and remarks on this subject, (*Philosophical Magazine*, V. IX. p. 355,) which appear to me very interesting. By his mode of distilling wood in iron cylinders, he deprives it completely, of all the volatile oil, hydrogenous gas and pyroligneous acid. The charcoal prepared in this way, possesses uniformly the same properties, and by the employment of it, the powder now used in the British ordnance, is increased in strength one third.

The gunpowder manufactured in the United States, is said to be defective, from a disposition either to effloresce or deliquesce. The salts most liable to effloresce are such as have soda for their base. In many of our saltpetre caves, small quantities of the sulphate of soda have been discovered, which for want of sufficient care or skill in refining, are suffered to remain with the nitre. The disposition to efflorescence appears to be directly opposite to that of deliquescence; as in the one case, the air has a stronger affinity for the water of combination of the salt than that which exists in the salt for the water; in the other case the salt attracts moisture from its combination with air. It would seem then, that, as the air is capable of depriving the sulphate of soda of its water of combination, and as nitrate of lime attracts moisture from the surrounding air, it is possible, that a mixture of these two salts may be so made with nitrate of potash, that the nitrate of lime may deprive the sulphate of soda of its water of combination, and in consequence of this addition of water, deliquescence may ensue, even when the atmospheric air and moisture are excluded. If Count Rumford is correct in supposing that the explosive force of gunpowder depends not upon the evolution of permanently elastic fluids or gases; but upon the almost instantaneous conversion of the water of combination existing in the powder, into steam by the caloric resulting from its inflammation; this explosive

force may be diminished for want of that water which might have escaped by *efflorescence*, or on account of the slow combustion of the powder consequent on *deliquescence*.

A concern for the glory and defence of our country should prompt such of our chemists as have talents and leisure to investigate this interesting subject. In 1776, at the request of M. Turgot, the celebrated M. Lavoisier was appointed superintendant of the French national powder works, and with what success he executed the duties of his important commission the history of their subsequent naval campaigns have sufficiently evinced. The efforts of European chemists, seem to have been principally directed to the removal of the marine salt which the nitre of Spain and India contains in great quantities. In the nitre of Kentucky, I have never detected a particle of that salt, and I am confident, that if any is found in it, the proportion must be very inconsiderable indeed. The rock saltpetre I am persuaded, would, with very little refinement, make gun-powder capable of retaining its efficient properties during the longest voyages, as I have never discovered, in that species of nitre, the smallest tendency either to deliquescence or efflorescence.

It will be observed, that I have not in this paper, hazarded any opinion with regard to the formation of nitre in our sand rocks. I freely confess that I have no theory on that subject which is satisfactory to my own mind, I am even disposed to suspect, that our greatest chemists have still much to learn with regard to this salt, so valuable in time of peace, so indispensable in time of war.

#### AMERICAN MANUFACTURES.

We extract from the "Report of the Secretary of the Treasury (Mr. Gallatin) on the state of American Manufactures in 1810," the following account of those manufactures which are immediately dependent on the Mineral Kingdom.

*Iron and Manufactures of Iron.*

The information received respecting that important branch is very imperfect. It is, however, well known, that iron ore abounds, and that numerous furnaces and forges are erected throughout the United States. They supply a sufficient quantity of hollow ware, and of castings of every description: but about 4,500 tons of bar-iron are annually imported from Russia, and probably an equal quantity from Sweden and England together. A vague estimate states the amount of bar-iron annually used in the United States, at fifty thousand tons, which would leave about forty thousand for that of American manufacture. Although a great proportion of the ore found in Vermont, Pennsylvania, Maryland and Virginia, be of a superior quality, and some of the iron manufactured there equal to any imported, it is to be regretted that, from the great demand, and from want of proper attention in the manufacture, much inferior American iron is brought to market. On that account, the want of the ordinary supply of Russian iron has been felt in some of the slitting and rolling mills. But whilst a reduction of the duty on Russian iron is asked from several quarters, it is generally stated, that a high or prohibitory duty on English bar, slit, rolled and sheet iron, would be beneficial; that which is usually imported on account of its cheapness, being made with pit-coal, and of a very inferior quality.

The annual importations of sheet, slit, and hoop iron, amount to five hundred and sixty-five tons; and the quantity rolled and slit in the United States is estimated at seven thousand tons. In the state of Massachusetts alone, are found thirteen rolling and slitting mills, in which about 3,500 tons of bar-iron, principally from Russia, are annually rolled or slit. A portion is used for sheet-iron and nail-rod, for wrought nails; but two thirds of the whole quantity of bar-iron, flattened by machinery in the United States, is used in the manufacture of *cut nails*, which has now ex-

tended throughout the whole country, and being altogether an American invention, substituting machinery to manual labour, deserves particular notice. It will be sufficient here to state, that the annual product of that branch alone, may be estimated at twelve hundred thousand dollars, and that, exclusively of the saving of fuel, the expense of manufacturing cut nails is not one third part of that of forging wrought nails. About two hundred and eighty tons are already annually exported, but the United States continue to import annually more than fifteen hundred tons of wrought nails and spikes. An increase of duty on these, and a drawback on the exportation of the cut nails, is generally asked for.

A considerable quantity of blistered, and some refined steel, are made in America; but the foreign importations exceed 11,000 cwt. a year.

The manufactures of iron consist principally of agricultural implements, and of all the usual work performed by common blacksmiths. To these may be added anchors, shovels and spades, axes, sithes, and other edge-tools, saws, bits and stirrups, and a great variety of the coarser articles of ironmongery; but cutlery, and all the finer species of hardware and of steel work, are almost altogether imported from Great-Britain. Ball, shells, and cannon of small calibre, are cast in several places; and three foundries for casting solid, those of the largest calibre, together with the proper machinery for boring and finishing them, are established at Cecil county, Maryland, near the city of Washington, and at Richmond, in Virginia: each of the two last may cast 300 pieces of artillery a year, and a great number of iron and brass cannon are made at that near the seat of government. Those of Philadelphia and near the Hudson river, are not now employed. It may be here added, that there are several iron foundries for casting every species of work wanted for machinery, and that steam engines are made at that of Philadelphia.

At the two public armouries of Springfield and Harper's ferry 19,000 muskets are annually made. About twenty thousand more are made at several factories, of which the most perfect is said to be that near New-Haven, and which, with the exception of that erected at Richmond by the state of Virginia, are all private establishments. These may, if wanted, be immediately enlarged, and do not include a number of gun-smiths employed in making rifles, and several other species of arms.—Swords and pistols are also manufactured in several places.

Although it is not practicable to make a correct statement of the value of all the iron and manufactures of iron, annually made in the United States, it is believed to be from twelve to fifteen millions of dollars. The annual importations from all foreign countries, including bar-iron, and every description of manufactures of iron or steel, are estimated at near four millions of dollars.

#### *Copper and Brass.*

Rich copper mines are found in New-Jersey, in Virginia, and near Lake Superior; but they are not now wrought. The principal manufactures of that material, are those of stills and other vessels; but the copper in sheets and bolts is almost universally imported; and the only manufacture for that object, which is at Boston, not receiving sufficient encouragement, although a capital of 25,000 dollars has been vested in a rolling-mill and other apparatus. The true reason is, that those articles are imported free of duty; and the owners seem to be principally employed in casting bells and other articles.

Zinc has lately been discovered in Pennsylvania; and there are a few manufactures of metal buttons, and various brass wares.

*Manufactures of Lead.*

Lead is found in Virginia and some other places, but the richest mines of that metal are found in Upper Louisiana, and also it is said in the adjacent country, on the east side of the Mississippi. They are not yet wrought to the extent of which they are susceptible, and after supplying the western country, do not furnish more than two hundred tons annually to the Atlantic states.

The annual importations from foreign countries of red and white lead, amount to 1,150 tons.

And those of lead itself, and of all other manufactures of lead, to 1,225 tons.

The principal American manufactures are those of shot and colours of lead. Of the first, there are two establishments on a large scale at Philadelphia, and another in Louisiana, which are more than sufficient to supply the whole demand, stated at six hundred tons a year. Five hundred and sixty tons of red and white lead, litharge, some other preparations of that metal, are made in Philadelphia alone. A repeal of the duty of one cent per pound on lead, and an equalization of that on the manufactures of lead, by charging them all with the two cents per pound laid on white and red lead, is asked by the manufacturers.

Various other paints and colours are also prepared in Philadelphia and some other places.

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*Tined, Japaned, and Plated Wares.*

The manufacture of tin ware is very extensive, and Connecticut supplies the greater part of the United States with that article; but the sheets are always imported. The manufacture of plated ware, principally for coach-makers and saddlers, employs at Philadelphia 73 workmen; and the

amount annually made there exceeds one hundred thousand dollars.. There are other similar establishments at New-York, Baltimore, Boston and Charleston.

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### *Gunpowder.*

Saltpetre is found in Virginia, Kentucky, and some other of the western states and territories ; but it is principally imported from the East-Indies. The manufacture of gunpowder is nearly, and may at any moment be made altogether adequate to the consumption ; the importation of foreign powder amounting only to 200,000 pounds, and the exportation of American powder to 100,000 pounds. The manufacture of Brandywine, which employs a capital of 75,000 dollars, and 36 workmen, and is considered as the most perfect, makes alone 225,000 lbs. annually, and might make 600,000 lbs. if there was a demand for it. Two others, near Baltimore, have a capital of 100,000 dollars, and make 450,000 lbs. of a quality said lately to be equal to any imported. There are several other powder-mills in Pennsylvania and other places ; but the total amount of gunpowder made in the United States is not ascertained.

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### *Earthen and Glass Ware.*

A sufficient quantity of the coarser species of pottery is made every where ; and information has been received of four manufactures of a finer kind lately established. One at Philadelphia, with a capital of 11,000 dollars, manufactures a species similar to that made in Staffordshire, in England, and the others, in Chester county in Pennsylvania, in New-Jersey, and on the Ohio, make various kinds of Queen's ware.

Information has been obtained of ten glass manufactories,

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which employ about 140 glass-blowers, and make annually 27,000 boxes of window-glass, containing each 100 square feet of glass. That of Boston makes crown glass, equal to any imported : all the others make green or German glass, worth 15 per cent. less ; that of Pittsburgh uses coal, and all the others wood for fuel.

The annual importations of foreign window-glass amount to 27,000 boxes ; the extension of the domestic manufacture, which supplies precisely one half of the consumption, being prevented by the want of workmen.

Some of those manufactories make also green bottles and other wares : and two works, employing together six glass-blowers, have been lately erected at Pittsburgh, and make decanters, tumblers, and every other description of flint glass of a superior quality.

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*Chemical Preparations.*

Copperas is extracted in large quantities from pyrites in Vermont, New-Jersey and Tennessee. About 200,000 lbs. of oil of vitriol and other acids, are annually manufactured in a single establishment at Philadelphia. Various other preparations and drugs are also made there, and in some other places, and the annual amount exported exceeds 30,000 dollars in value.

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*Salt.*

The Salt Springs of Onondago and Cayuga, in the state of New-York, furnish about 300,000 bushels a year ; and the quantity may be increased in proportion to the demand. Those of the western states and territories supply about an equal quantity ; that known by the name of the Wabash Saline, which belongs to the United States, making now

130,000 bushels. Valuable discoveries have also lately been made on the banks of the Kenhawa. But the annual importation of foreign salt amounts to more than three millions of bushels, and cannot be superseded by American salt, unless it be made along the sea-coast. The works in the state of Massachusetts are declining, and cannot proceed, unless the duty on foreign salt should again be laid. It is necessary to shelter the works from the heavy summer rains by light roofs moving on rollers. This considerably increases the expense; and it appears that the erection of ten thousand superficial square feet, costs one thousand dollars, and that they produce only two hundred bushels a year. A more favourable result is anticipated on the coast of North-Carolina, on account of the difference in the climate; and works covering 275,000 square feet have been lately erected there.

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## INTELLIGENCE.

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### ERUPTION OF VESUVIUS.

*Naples, September 12, 1810.*

Two days ago a dull sound, with loud rumblings announced that the Vesuvius was in labour. Yesterday, at 4 o'clock in the afternoon, the eruption manifested itself, with circumstances of the most alarming nature, to Portica and Resina. A tempest which collected on the side of Vesuvius, displayed a thick column of smoke, ascending from the mountain, which rose to a prodigious height. As the day declined, the reddish colour of the smoke assumed a deeper hue, and at night all the mountain appeared to be on fire. At 10 o'clock the thunder had ceased: Vesuvius no longer vomited its flames, but the lava flowed in abundance, and all the plain, on the right of the hermitage was covered with it; the flames rendering every part perfectly lucid, the plain ap-

peared a sea of fire. The lava descending from the crater, flowed with a deep dull sound, by two large openings ; one on the side of Resina, the other on the side of Bosco do Case, in the direct line of Gioacchinopoli. The divisions of the lava, taking this course was the means of saving the first mentioned town, which would have been destroyed, and perhaps Portica likewise, if all the lava had taken that direction. Some houses were buried, in the neighbourhood of Bosco, and several vineyards were consumed. Happily the eruption lasted but a few hours, when the flow of lava abated ; but all the inhabitants suffered the greatest anxiety. Never was there from Vesuvius such an immense quantity of lava, in so short a time. It covered an extensive tract of country, even to the Gulf of Salerno. *Journal du Commerce.*

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NEW EDITION OF HAÜY'S MINERALOGY.

We are happy to learn by a letter from the Abbe Haüy, that he is at present engaged in preparing for the press a new edition of his celebrated System of Mineralogy, which will be enriched by many important additions.

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ALLANITE.

Dr. T. Thompson, of Edinburgh, has lately analysed a mineral which he has named *Allanite*, in compliment to Mr. T. Allan, of Edinburgh, who first pointed it out as a substance not hitherto noticed. It is of a dark brown colour, has a vitreous fracture, and greatly resembles gadolinite. Dr. Thompson found this mineral to consist of silex, oxide of iron, oxide of cerium, and a small portion of lime and alumine,

## SODALITE.

A new substance has lately been examined, which from the large quantity of Soda which enters into its composition, has, by Dr. Thompson, been called *Sodalite*. It is of a light green colour, occurs crystallized in garnet shaped dodecahedrons, with sahlite, augite and garnet. It has been examined by Dr. Thompson and M. Ekeberg. The following is the result of their analyses :

	Thompson.	Ekeberg.
Silex	38 52	36
Alumine	27 48	32
Lime	2 7	
Iron	1	25
Soda	23 80	25
Muriatic acid	3	6 75
Volatile matter	2 1	
Loss	1 7	
	<hr/> 100	<hr/> 100

## MR. GREVILLE'S CABINET.

This splendid collection of minerals has been lately purchased by the British government for 13,727*l.* sterling, and now forms a part of their National Museum. The commissioners appointed to examine and value this cabinet, in their report to the committee of the House of Commons, concurred unanimously in giving a public testimony of the merits and services of Count Bournon, to whose exertions and talents the systematic arrangement of this collection is due.

## INDICOLITE.

This fossil, which from its fine blue colour, and resemblance to indigo, obtained from Dandrada the name of indicolite, has of late been ascertained to be a blue variety of tourmaline, and as such has been described by M. Haüy, as the *tourmaline azuré*. Hitherto this mineral has

been sparingly found in Europe. In the mine of Utöe in Sweden, it occurs in a rock composed of quartz and felspar.

The blue tourmaline has lately been discovered at Goshen, in Massachusetts. It is of different shades, varying from a deep and almost black, to a light azure blue. It occurs in granite; the felspar of which is white and tabular, resembling some varieties of Adularia we have met with in the Swiss Alps. It is generally opaque, though sometimes translucent, and in a few instances transparent. In some specimens, the felspar, is granular; and it is in these, the smaller azure blue crystals of tourmaline most usually occur. The mica is yellowish; sometimes violet, and frequently of a silvery hue.

The form of this blue tourmaline is the three-sided prism, bevelled on each of the lateral edges, and terminated by low trihedral pyramids. The large crystals appear black, except on the edges, which are translucent, and which when held between the eye and the light, produce a most beautiful deep blue colour. In some instances, the edges of the crystals are of a sea green. We have received a suite of specimens of this interesting mineral, from Mr. Weeks, of this city, on whose estate it occurs, and to whom we are indebted for the discovery.

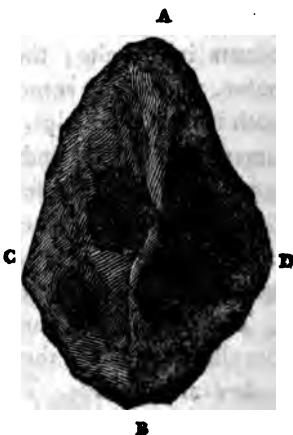
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#### BLUE IRON EARTH.

Professor Clarke, of Cambridge, (E.) the author of *Travels through Russia, Tartary, Turkey, &c.* in a letter to the editor, upon the subject of this mineral, observes: "a similar deposit occurs in the mouth of the Cimmerian Bosphorus, now called the Straits of Taman, between the sea of Azof and the Black Sea. The phosphat of iron there lies associated with extraneous fossil remains of animals, whose decomposition afforded phosphoric acid to the metal."

## MASS OF MALLEABLE IRON.

There is at present in this city a mass of Iron, which was sent hither a short time since from New-Orleans, by Mr. G. Johnson, and which, from its size and weight has excited considerable attention. Its form, which is irregular, may be understood by a reference to the marginal sketch. Its length, A. B. is 3 feet, 4 inches; and its greatest breadth, C. D. is 2 feet, 4 1-2 inches. It weighs upwards of 3000 lbs. Its surface, which is covered by a blackish crust, is greatly indented, from which it would appear that this mass had been in a soft state. On removing the crust, the iron, on exposure to moisture, soon becomes oxidated. Specific gravity. 7. 400.



It appears to consist entirely of Iron, which possesses a high degree of malleability; experiments having been made without detecting nickel or any other metal. This enormous mass of Iron is said to have been found near the Red River. We regret extremely, that we are unable to say much as to its geognostic situation or origin, whether native, meteoric or artificial. We hope, however, from the enquiries we have instituted, to have it in our power shortly to lay before our readers some satisfactory information respecting this interesting object.

## ZIRCON.

This mineral, the geognostic situation of which is so little known in Europe, has lately been discovered *en place*, near Trenton, New-Jersey, by Mr. Solomon W. Conrad, who has obligingly promised to furnish us with a full account of this new substance, which we shall insert in the next number of the Journal.

**SULPHURET OF ANTIMONY.**

In recently examining some mineral productions from Louisiana, we were much gratified in observing several very rich specimens of this highly valuable ore. Antimony is at present in so much demand that our type-founders, in consequence of the difficulty of obtaining it from Europe, have for some time past been nearly at a stand. From the assurance that this ore occurs in very considerable quantities, we are in hopes that such will be the supply, that our types ere long, will be manufactured entirely from American materials.

**CHROMIC YELLOW.**

This beautiful pigment, produced by the artificial combination of lead with chromic acid, has for some time past been manufactured at Philadelphia by Mr. Godon, who has obtained the acid from a native chromate of iron, found in the vicinity of Baltimore. This yellow, in every respect equals, if not surpasses, the natural chromate of lead, so highly esteemed by the Russian painters, and which hitherto has only been found in Siberia. We shall, in our next number, lay before our readers, an account of the Baltimore chromate of iron.

**CAROLINA GOLD.**

We are indebted to the politeness of Mr. Cloud, for the following statement of the quality, amount in gross and standard, together with the intrinsic value of the gold received at the mint, from Cabarras county, North-Carolina.

		Carats, Grs.				Ounces, Dwts. Grs.				Dolla. Cts.	
Quality.	Best	23	00	} Amount.		Gross	1341	9	21	} value,	24689 29
	Worst	22	04			Stand'd	1389	5	14		

It will be found, from the above statement, that the North-Carolina gold is superior in quality to the gold coins of the United States, England and Portugal, their standard being 22 carats. The native alloy of the Cabarras gold is silver, with a small portion of copper.

## NEW ELEMENTARY WORK ON MINERALOGY.

Mr. Godon, of Philadelphia, proposes publishing by subscription, "*a Treatise on Mineralogy adapted to the present State of Science, including important applications to the Arts and Manufactures.*" This work, will consist of two volumes 8vo. with one volume of plates, in 4to.

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## TANTALIUM.

A translation of Dr. Wollaston's paper on the Identity of Columbium and Tantalum, as inserted in our last, has appeared in the 165th number of the *Journal des Mines*, published at Paris: to which is subjoined the following note of the translator. "M. Berzelius, in a letter to M. Vauquelin, which is inserted in the 61st volume of the *Annales de Chemie*, announces, that Mr. Gahn had found, by means of the blow-pipe, that tantalum was nothing more than tin, combined with an earth, the nature of which had not yet been ascertained.

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## BENJAMIN D. PERKINS.

In the death of this gentleman mineralogy has lost one of its most zealous promoters in this country. Mr. Perkins, early in life, had imbibed a taste for this useful branch of science, which he pursued with the greatest ardour. When in Europe, he formed a cabinet of well-characterized specimens, which is now the property of Yale College, his alma mater, and serves to illustrate the excellent lectures delivered in that highly respectable institution.

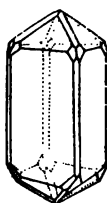
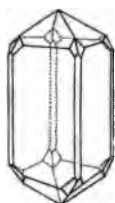
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## CABINET OF MINERALS, AT YALE COLLEGE.

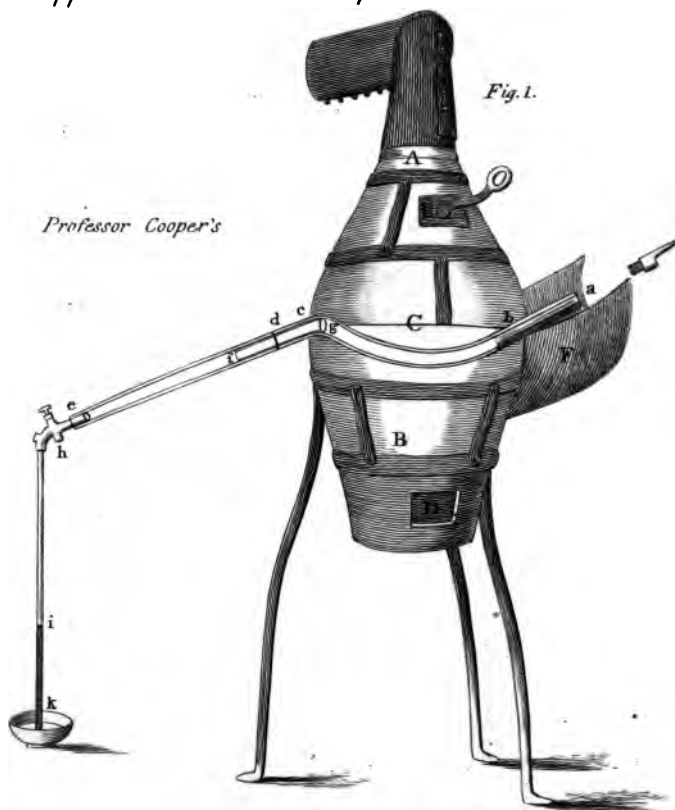
We are happy to inform the public, that the celebrated collection of minerals, formerly belonging to Mr. Gigot d'Orcy, of Paris, has been deposited by Col. Gibbs, the present proprietor, at Yale College, New-Haven. The students of mineralogy, at that seminary will now enjoy every advantage in pursuing that study, from this collection, and from the zeal and talents of Professor Silliman.



*Zircon from Trenton.*

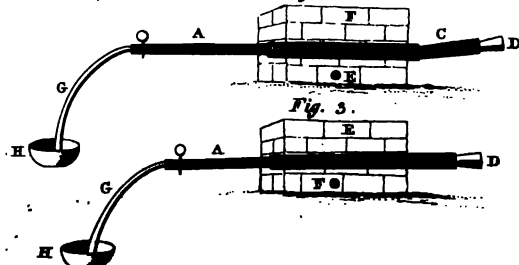


*Apparatus for the Decomposition of Potash.*



*M<sup>r</sup> Chilton's*

*Fig. 2.*



# THE AMERICAN MINERALOGICAL JOURNAL.

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## NUMBER III.

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**XXII.** *Mineralogical Notice respecting ZIRCON, from Trenton, New-Jersey, by Mr. SOLOMON W. CONRAD.*

**H**ITHERTO the Zircon or Jargon has been esteemed one of the rarer productions of the Mineral Kingdom, and little respecting its natural repository has as yet been ascertained.

In the island of Ceylon, where it was first discovered, and to which it appeared almost exclusively to belong, it is found, we are told, in the sands of a river, accompanied with rubies, and other crystallized gems. Lately, however, we are informed by various authorities, it has been met with near Frederickswarn, in Norway, and according to Klaproth, \*for the first time with its gangue, which is a coarse-grained stony mass, consisting of a reddish feldspar, with black basaltic hornblende, in which the zircon is sparingly

\* Analyt. Essays, vol. 2.

imbedded in transparent light-brown crystals, belonging to the octahedral form.

As I recently observed this interesting mineral, the existence of which in our country is not generally known, some account of it may perhaps merit a place in the *Mineralogical Journal*.

In a cluster of primitive rocks which stand on the margin of the Delaware, near Trenton, in New-Jersey, there are masses observed, of a light-green feldspar, and blueish white quartz, in which the Zircon occurs imbedded.

The rocks are composed of black mica, quartz, and feldspar, with garnets interspersed, and appear to partake of the nature of Gneiss. They are part of that primitive range, which passing under the Delaware in a south west direction, forms the falls in that river.

The colour of the crystals is a deep brownish red ; their form a rectangular four-sided prism, acuminate by four planes, which are set on the lateral planes, with the solid angles bevelled, and the lateral edges of the prism truncated ; and in some instances, the edges formed by the meeting of the planes of accumulation, are also truncated. Sometimes the bevelling planes stretch so far towards the apex of the crystal that the acuminate planes are scarcely visible. The crystals are small, rarely exceeding the fourth of an inch in length ; they are smooth and shining, and nearly semi-transparent. In their other characters they correspond with the description given in the books of mineralogy.

**XXIII.** *An Amendment proposed to the Geological Chart of the United States, as respects the character of the north side of Long-Island, which is shown to be alluvial and not primitive, as therein stated: in a letter from the Hon. SAMUEL L. MITCHILL, M. D. M. C. &c. to the Editor.*

NEW-YORK, July 4th, 1811.

DEAR SIR,

**I**N the sixth volume of the Philadelphia Philosophical Transactions, is an able and instructive memoir by William M'Clure, Esq. on the geology of the United States; accompanied by a map, coloured in such a manner as to present the different formations strongly to the eye. They are the same which you showed me lately, as having been sent you in the form of a pamphlet, by one of your correspondents in Paris.

In these I observe, that the north side of Long-Island is represented as *primitive*, while the south is described as *alluvial*. The ridge of hills which extends the greater part of its length, from the west to the east, is the barrier.

Of the correctness of the memoir and chart, as far as the alluvial character of Mattawacks is concerned, I entertain no doubt. But I have reason to suppose, that the portion of that island, which has been delineated as primitive, is, with very moderate exception, alluvial also.

Formerly, indeed, I was of a different belief. In my report to the Agricultural Society, in 1796, on the mineralogical history of New-York, I classed this among the primeval islands. I was induced so to do, on account of the masses of loose and detached granite, schærl, and asbestoid, strewed over the region situated between the hilly ridge and the Sound; the dissimilarity of that soil, and configuration from the tract lying between the ridge

and the ocean; the greater resemblance which the north side of the island bears to the contiguous continent; and above all, the strata of granite and gneiss which occur at and near Hurlgate, on the Long-Island-side of that remarkable pass.

Further observation has led me to suppose that both sides of Long-Island are alluvial, with the exception of the granitical layers before mentioned, being in Newtown: and I deem it but just to myself and the subject, as well as to those who may have been misled by following my former opinion, to state the reasons which have induced me, in some degree, to change it.

The first piece of evidence was derived from an examination of the strata penetrated by a well-digger, in the town of North-Hempstead, in 1804. The place where this opening was made, is in the land of Mr. G. Rapalje, on the road extending across the head of Cow-Neck, between Great-Neck and Hempstead-Harbour. The well was eighty feet deep; and the appearances were as follow:

1st. Sandy loam, or a mixture of clay and small gravel—10 feet.

2d. Compact clay—1 foot.

3d. Sand and gravel—9 feet.

4th. Gravel and roundish stones, chiefly of quartz and granite, breccias and argillaceous iron-ore, of the size and form of paving-stones—10 feet.

5th. Masses of grey granite jumbled together—5 feet.

6th. Gravel and roundish stones, as in the 4th stratum—3 feet.

7th. Hard loam—3 feet.

8th. Soft clay—six inches.

9th. Sea-sand, resembling that found on the shores of tide-water; sharp grit; coarse gravel, and rounded or water-worn stones, variously mixed, and alternately deposited—38 1-2 feet.

10th. Water—80 feet deep.

The second proof was afforded by an inquiry into the stratification towards the west end of the island, in the town of Brooklyn. The result of an examination of the materials thrown out of Mr. Johnson's well, eighty-four feet deep, in a spot between Wallaboght and Guanias, during April, 1811, was this :

1st. Sandy loam—3 feet.

2d. Hard concretion, requiring the pick-axe to break it up ; formed chiefly of clay, sand, and stones, and strongly tintured with iron of a yellowish red colour ; and intermingled with rocks of gneiss, hornblende, and brittle ferruginous slate—15 feet.

3d. Loose gravel, and greyish sand mixed with thin streaks of gravel ; the sand coarse, quartz, and of a sharp grit ; the gravel mixed with small masses of white quartz, and black touch-stone, with now and then breccias, micaceous slate and ferruginous sand-stone—20 feet.

4th. Alternate layers of sand and gravel, not more than two or three feet thick, containing sometimes rounded pieces of coarse green soap-stone, in addition to the materials in the stratum immediately above it—17 feet.

5th. After having thus descended fifty-five feet, strata of sand and gravel occur by turns. They do not respectively exceed three or four feet in thickness, and contain marine shells, mostly of clams and oysters. And it is remarkable that these animal remains are never found in the strata of sand, but uniformly in those of the gravel only—29 feet.

6th. Water, at the depth of 84 feet.

The third consideration in favour of the alluvial constitution of the north side of Long-Island, is deduced from the frequent occurrence of animal and vegetable substances at considerable distances below the earth's surface. I shall state to you a few, out of a great number of cases.

The shells of *clams* and *oysters* are found almost univer-

sally, sixty feet under ground, in Brooklyn, New-Utrecht, Flatbush and Newtown. A *periwinkle shell* was discovered forty-three feet down, at New-Utrecht. In Newtown, *carbonated wood*, sometimes by itself, and sometimes incrustated by pyrites, was raised from the bottom of a shaft fifty feet deep. In Bushwick, at the depth of forty-five feet, they found *the body of a tree* lying across the well they were digging, and they cut through it, rather than abandon the job. I say nothing of the *wood* discovered sixty feet deep, a little to the eastward of Westbury meeting-house : nor of *the bark, and other parts of a tree*, raised from the depth of forty feet at Eastwoods ; because both these places are situated to the south of the barrier-ridge, and are within the district allowed by all to be alluvial. But I will mention the fact, of *wood* found at Success, on the very summit of the hills, thirty feet beneath the sward.

These facts appear to be conclusive on the subject. Yet there are two difficulties to be overcome. The first is, the *stratified granite* on the shore of Long-Island, at Hurlgate and its neighbourhood ; and the second, the *detached masses of the like material*, varying from the bulk of two or three feet square, to the magnitude of the *mill-stone-rock*, a solitary block which I have computed elsewhere, (3 Med. Rep. p. 330) to contain twenty thousand and four hundred cubic feet.

The stratified granite of Long-Island, reaches not many miles along the shore, and that only between Flushing Bay and Newtown Creek. It seems to extend from the shore toward the interior, no great distance ; apparently but a few rods.

In contemplating the loose and nodular rocks of primeval date, it is not easy to assign a perfectly satisfactory reason for their appearance, in such a state of dispersion, among materials of recent formation. But it is a fact that alluvial strata, in the very city and vicinity of New-York, are superinduced upon the primitive. Stratified granite,

gneiss and steatites, constitute the old basis of the Manhattan island ; and yet in digging away Bayard's hill, the heights near Corlear's Hook, and the other natural elevations, which are yet partially in being, we uniformly observe horizontal strata abounding in water-worn stones, which are very serviceable in paving the streets. These alluvial deposits overlay the more ancient beds of rocky matter. They may fairly be considered as the ruins of older strata, or as derived therefrom. And if, in the changes that the materials have undergone, some fragments have not been worn away nor reduced so small as others, but still retain considerable bulk, their existence can, nevertheless, be reconciled to geological principles. The same cause which was powerful enough to arrange the alluvial layers, as we find them, may have brought along detached and solitary parcels from their original abodes.

On the whole, the only primitive strata upon Long-Island exist at Hurlgate ; and there they form but a very narrow strip ; a mere margin of the shore, for the distance of between four and five miles. This being the fact, I hope our ingenious and enterprising friend may soon receive information about it, and amend the next edition of his chart accordingly.

While I congratulate you on the rapid progress of mineralogical and geological researches in our country, permit me to renew the assurance of my particular esteem and consideration.

SAM. L. MITCHILL.

**XXIV.** *Account of the decomposition of POTASH and production of POTASSIUM, by heat: by THOMAS COOPER, Esq. Professor of Chemistry in Carlisle College, Pennsylvania, communicated to the Editor by Mr. WILLIAM HEMBEL, Jun'r.*

PHILADELPHIA, 12th July, 1811.

*Dr. Bruce,*

SIR,

**T**HE many abortive attempts which have been made by different chemists in our country to obtain potassium, gives a value to the accompanying letter (which I received from Thomas Cooper, Esq. of Northumberland, Pennsylvania) which in my opinion merits publicity. Should you, Sir, be of my sentiment, be pleased to give it a place in your useful Journal.

I remain, Sir,

With great esteem, your ob't servant,

WILLIAM HEMBEL, Jun.

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“ The specimen you sent me of Potassium by Mr. Reuben Hains, procured by Mr. Johns, by means of his apparatus, in England, arrived here in full perfection; protected by the Naphtha. It appeared to be enveloped in a soapy coating, formed by the union of the external surface of Potassium partially reconverted into Potash, and united with the oleaginous matter of the Naphtha. But on cutting it, the blue mercurial metallic brilliancy was evident; and it decomposed water with a vivid pink-coloured flame, and a gyratory motion, as you described it.

“ I was so struck with the phenomena attending its decomposition of water, that I determined to make some if I

could, and invited Mr. Hains to assist me in the progress of the experiment, to which he willingly consented.

“ I looked over the method of making it at the Royal Institution in England, as described in Nicholson’s Journal, and the improvement on that apparatus, which Mr. Johns had published in Tilloch’s Magazine; and adopted the latter.

“ Dr. Priestly’s Laboratory was well furnished with gun-barrels. I took one, and had it filled with melted lead, for the purpose of giving the necessary curve; but this did not succeed.

“ The lead was melted out, and by repeated red-heats, and careful hammering, the required curvature was produced; but the barrel was too thin, and it cracked in the operation.

“ I took another, which seemed to answer very well. I had another piece of gun-barrel ground to it as an *alongé*; the further extremity being furnished with a brass cock, to which was connected by means of a cork, a glass tube, the further end of which was immersed in a small basin of linseed oil. An intermediate tube of sheet-iron, for the purpose of collecting the distilled Potassium (about six inches long) was inserted half within the curved tube, and half within the *alongé*, which was carefully and accurately ground, to fit the curved tube. The curvature within the furnace, was filled, for the length of nine inches, with chippings of malleable iron; for I could procure neither clean iron filings, or turnings. The other end of the gun-barrel (at the breech) was stopped by the common screw used in all gun-barrels.

“ The apparatus thus made, was fixed in a portable air-furnace, of nine and an half inches, internal diameter, furnished with a dome, and a pipe of about four feet in length. The filings were exposed to a full white heat, in this (very excellent) air-furnace, and then, the screw at the breech being taken out, about an ounce of fused caustic potash

was gradually put in; the projecting end of the tube next the breech being previously exposed to red heat.

" Having no perfectly pure alkali, and not being satisfied with Berthollet's process of procuring it, by dissolution in alcohol, either in point of ease or purity, I made it myself, thus :

" I took about a pound and an half of lime ; I exposed it in a large black-lead crucible to a full red heat, for four hours ; I mixed one pound of this, with one pound of good pearlash ; I poured on it one and an half gallon of boiling water, and after stirring it, left it to subside for two hours. On adding an acid to a small quantity of the clear solution, not the smallest appearance of effervescence was observed. I poured off the clear liquor, filtered it through cotton, washed the remaining sediment with one and an half gallon more of boiling water, filtered it, then evaporated the whole over a charcoal fire in the open air. This was done in a large copper basin, silvered with the common mixture of muriate of silver one part, whiting one and an half part, cream of tartar one and an half part. Being evaporated nearly to dryness, it was tried with an acid, a *slight* effervescence appeared, probably from the absorption of carbonic acid from the atmosphere, during four hours evaporation. The nearly dry solution was then put in a clean iron crucible, gradually boiled, and then melted in a low red heat. It was then cast on the copper basin, and whilst hot, broken into pieces, and put into a glass bottle. In this way, a pound averdupois, of pearlash, will furnish nearly four oz. troy, of solid fused caustic alkali.

" The curved part of the gun-barrel, containing the filings, being of a white heat, and six inches of the breech end which projected out of the furnace being brought to a red heat by the application of hot charcoal, the potash (about one ounce) was put in, and the breech closed with its screw.

" All the other joints were luted with fat lute (lime and linseed oil.) Hydrogen gas came over abundantly; the

heat was continued for half an hour, the apparatus cooled, taken to pieces, examined, but not a particle of potassium!

"On carefully examining the gun-barrel, three small holes appeared to have been burnt into it. To which the failure was attributed. Another gun-barrel was taken, bent, ground, filled with iron chippings, the experiment was conducted as before, but the barrel was not accurately ground to the straight joint or *alongé*; this failed also.

"A thick well made rifle-barrel was then taken, it was filled with a faggot of clean iron wire; the experiment was conducted as before. The caustic alkali was distilled over in substance, chiefly undecomposed, but the surface of the cake of alkali exhibited unequivocal signs of potassium; the scrapings taking fire in the air, and most vividly on water.

"Monday, June 24th, finding the interstices between the wire too great, I directed the wire to be cut into small pieces of about an eighth of an inch long; the curvature of the gun-barrel was lessened; it was filled with these cuttings; an ounce of dry, fused, caustic potash was used; the *alongé* furnished with a brass cock, was screwed to the curved barrel by three small screws. All the joints were luted with fat lute. The white heat was given to the curvature of the barrel, the red heat to the projecting end of the breech. The potash was put in at twice; this took ten minutes; much hydrogen gas escaped, both at the breech and the glass tube, which was now immersed in olive-oil. The heat was kept up about fifteen minutes. In half an hour the apparatus was taken out, cooled, taken to pieces, and as much potassium procured as would fill one fourth of an ounce vial. It was of the purest and most brilliant silvery lustre. It took fire in the air, and vividly in water. It was soft, spread under the knife, and appeared to have all the most perfect qualities of the purest potassium hitherto made. I could not weigh it, but I am not beyond the mark in saying we procured sixty grains.

"I had not half sufficient naphtha to cover it. It decomposes olive-oil, with great frothing; and was quickly deteriorated. It sunk in ol. tereb. decomposing it, and producing constant streams of gas, which gave a frothy appearance to the spirits of turpentine, and in about three hours, turned of a dark brown colour, the potassium still retaining its silvery metallic lustre. How it will arrive at Philadelphia, I know not. Mr. Hains will bring you the whole result.

"The chippings of wire are bright; they are no longer iron; they are not steel. I send them to you. What becomes of the oxygen? for certainly caustic potash is a metallic oxyd. There is no appearance of oxydated iron from the curved tube, nor of what Dr. Priestly and the English workmen call finery cinders.

"I am as yet unable to give an opinion. I finished my successful experiment this morning, and Mr. Hains goes off at 6 o'clock to-morrow morning. I shall write further to you when I know more.

"In the mean time I am with very kind respect,

"Dear Sir, your friend,

"THOMAS COOPER."

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*References to Plate I. Fig. I.*

A, B. An earthenware furnace, 2 feet in height, which may be separated at C. Diameter of the furnace: at A. 5 inches; at B. 7 inches; at C. 11 1-2 inches.

D. The ash pit.

E. Door to supply the fuel.

F. Sheet-iron bent, to contain a charcoal fire, outside the furnace, at the end of the present apparatus.

a. b. c. d. e. A bended gun barrel, divisible by an air tight joint at d. within which is inserted a tube of sheet iron, f. g. extending 3 inches each way from the joint,

- a. b. Six inches of the large end of the gun barrel, heated to redness, by a charcoal fire contained in F.
- b. c. Part of the barrel containing iron wire cut fine, to be heated to whiteness.
- c. d. Short bend of gun barrel, 3 inches : which begins to decline, immediately at leaving the inside of the furnace.
- d. e. Strait part of the gun barrel, 16 inches long, to be kept cool by the application of wet cloths. In the lower end of this is a brass cock h. connected with a glass tube i. inserted into a bowl of olive oil k. which rises in the tube after the hydrogen gas has ceased to come over.

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XXV. *Mineralogical and Geological observations on New-Haven and its vicinity.* By BENJAMIN SILLIMAN, Professor of Chemistry and Natural History in Yale College.\*

THE Mineralogy and Geological structure of New-Haven and its vicinity have been but recently examined with much attention. This examination is not yet completed, but the following facts, and the observations connected with them, will probably be found tolerably correct.

The plain on which New-Haven stands, is a secondary country, evidently of recent formation : it is wholly alluvial, and is composed of beds of siliceous sand and gravel, arranged in strata nearly parallel, and extending to a depth greater than any wells have yet penetrated. The sand is more or less ferruginous, and presents no interesting minerals, except such as appear to have been accidentally deposited, or brought from other situations ; viz. Quartz, Flint, Jasper, Feldspar, which are considerably abundant, and Agate, Sappare, and Garnets, which have been found in a few instances.

There are no rock formations in this plain, except a very

\* Read before the Connecticut Academy, with whose permission and approbation it is now published.

recent and friable sandstone, which occurs in a few places, and appears to be little more than an indurated mass, composed of similar materials, with the loose sand and gravel of the plain.

The fine amphitheatre of hills which encircles New-Haven in all parts, except those occupied by the water, presents an interesting variety, both as it respects its geological formation, and the individual minerals which have been discovered. On the eastern side of the harbour, the rocks are chiefly granite, green-stone, and sand-stone.

Only a few rocks of granite occur, and they are probably the commencement of those extensive granite ranges, which occupy the middle and eastern parts of Connecticut.

The sand-stone is extremely coarse, and may more properly be called, at least in many instances, a conglomerate, or pudding-stone.

Green-stone hills, accompany the sand-stone all along the eastern side of the harbour, as high as the village of Dragon, and probably much farther. The sand-stone is beneath, and the green-stone reposes on it. Steatite, or soap-stone, has been observed in this sand-stone, in small masses. The green-stone of these hills is broken into small fragments, most of which do not exceed two or three inches in length.

North-east and north-west of New-Haven, at the distance of two miles from the town, and from each other, rise two perpendicular eminences or bluffs, exhibiting precipices of naked rock, and called the East and West Mountains. Contiguous to these, are several smaller eminences of the same description, the largest of which runs off at right angles from West Rock, in an easterly direction, and is called Pine Rock. This assemblage of eminences forms the termination of several extensive ranges of the same nature, which run a great distance into the interior of New-England, forming numerous bold precipices, among which are the celebrated ones called Mount Tom, and Mount Holyoke, near Northampton. Our remarks, on this occasion, will

be confined to the East and West Mountains, and their immediate appendages. They possess so many features in common, that they may be considered together with advantage; while their distinct peculiarities may also be pointed out.

Although it is the province of mineralogical description to consider only the nature of the substances of which it treats, one cannot contemplate these eminences without admiring them, as forming bold and beautiful features in the scenery around New-Haven.

There can be no hesitation in pronouncing them to be green-stone rocks, called by the popular name of Whin, in Scotland; and Trap, more generally throughout Europe. The term Basalt, has been more loosely and inaccurately applied to rocks of this description. It properly belongs to one variety of this family, of which the Giants' Causeway, and the Cave of Fingal, are celebrated examples. There is a striking resemblance between the green-stone mountains of New-England, among themselves, and the same description of mountains in Scotland, and probably in other parts of the world. They present high mural precipices, perfectly naked and rude. Their fronts are composed of vast assemblages of columns, more or less regular, frequently affecting the prismatic form, with considerable, and sometimes with surprising regularity. A fine example of this latter circumstance occurs at Mount Holyoke. Rocks of this description are full of cracks and fissures, from which cause it probably arises, that they are prone to break off and fall; an effect which is doubtless produced by the freezing of water deposited in the cavities. Hence, vast masses of broken rocks, from the smallest size to that of the largest columns, are usually found sloping from the bases of these mountains up their fronts, sometimes for more than half their height. They are also distinguished by sloping backs, declining so gradually, that in the rear, the ascent is often easy, while in front it is impracticable.

These circumstances are no where more conspicuous than in the green-stone mountains of New-Haven. An observer placed at the foot of the West Mountain particularly, is forcibly struck with the grandeur and sublimity of the numerous and lofty columns which there form an extended front.

Those rocks are composed principally of feldspar and hornblende; among which quartz is sometimes interspersed. Iron enters considerably into their composition. Hence, during their decomposition, which takes place slowly in the weather, iron rust gradually covers the exterior of the stone, thus giving it a reddish brown appearance. The green-stone of New-Haven, has been found by experiment, to be fusible in a furnace, and to produce a blackish glass.

It may not be improper to remark, that it forms an excellent building stone, and is extensively employed for that purpose in New-Haven.\*

The green-stone mountains which have been described, belong to the class of secondary rocks. This is proved beyond controversy, (whatever system of geology be adopted) by the fact that they stand upon strata of sand-stone. Sand-stone is, by all geologists, acknowledged to be formed from the gradual disintegration of other rocks; and therefore, whatever other rocks repose on it, must necessarily be secondary. The junction of the sand-stone and the green-stone in these hills, may be distinctly perceived in a number of places.

There are some particular minerals found in these rocks which deserve notice. Iron pyrites, in minute pieces, and sometimes imperfectly crystallized, is found disseminated. Grey sulphuret of copper is sometimes seen, connected with crystallized quartz. Epidote occurs in veins. Prehnite occurs also in veins, and in nodules; having a distinctly

\* It is worthy of notice, that most varieties of the Trap or Green-stone rocks, if heated red-hot, plunged into water, and pulverized, become a good substitute for the Puzzolana of Italy, in forming a water-proof mortar for the construction of piers, docks, &c.

radiated structure, and the characteristic green colour of that mineral. Very beautiful specimens of it are found at the East Rock, crystallized, in veins, and in distinct globular concretions. This mineral probably abounds in the green-stone ranges of Connecticut; for it has been found at Farmington, near Berlin, and also at the Pine Rock. At the latter place, it forms numerous *perpendicular* veins, rarely exceeding one fourth of an inch in thickness. They are considerably decomposed and injured by the weather; nor have any specimens been found at the Pine Rock, which can compare either for soundness or beauty with those of the East Rock.

Another interesting mineral found in these rocks is, Zeolite. It occurs at the East Rock, but is most *abundant* at the Pine Rock. It is in veins, in superficial coatings on the stone, and in loose pieces lying among the broken rocks. There appear to be several varieties; viz. mealy Zeolite, lamellar or foliated, and radiated. The lamellar variety is frequently crystallized; but unfortunately, the specimens are so much injured, that they possess but little beauty. The veins of Zeolite, when found in place, are *horizontal*.

It may not be amiss to remark, that in deciding the character of the two last mentioned minerals, their specific gravity was ascertained to correspond with that mentioned in the systematical books. The Zeolite was found to be soft; to intumescere before the blow-pipe, and fuse into a white enamel, and to gelatinize with acids. The Prehnite intumesced before the blow-pipe, and melted into a greenish slag. It was so hard as to scratch glass, and give sparks with steel.

It is somewhat gratifying to find these minerals so common in the green-stone of the old world, associated also with that of the new.

Leaving the West Mountains, the circuit of the hills is to the south. New features here present themselves; not how-

ever without considerable resemblance to the country which we last described. For about four miles, ranges of green-stone continue, accompanied, however, and frequently interrupted by, extensive strata of a singular rock, to which it is not easy to give a name. It is universally schistose in its structure, and distinctly stratified. The direction of the strata is nearly the same with that of the hills. They incline generally to the west, sometimes at an angle of from 30 to 45 degrees, and sometimes becoming nearly horizontal. The rock is composed of distinct layers of quartz, varying from a mere line to an inch in thickness; between which are interposed layers of a distinctly slaty substance, which sometimes verges towards Mica, Talc, or Chlorite; at other times passes into clay slate and green-stone slate. It occasionally has a glistening appearance, is very soft, and has a distinctly saponaceous feel; but frequently its feel is dry and meagre.

Within about two miles of the sea-shore the green-stone ceases. The country becomes distinctly, and wholly stratified. The strata are similar to those which have been described; but nearer the shore, and contiguous to the village of West-Haven; the rock changes into a perfect slate, lying in very extensive and beautiful strata, forming continuous and high ledges, with intervening chasms. This slate appears to be intermediate, between argillaceous slate and chlorite slate; verging sometimes toward the one, and sometimes toward the other. The strata continue quite to the sea-shore, and jut upon it in abrupt and broken cliffs. Those cliffs, in some instances, run directly into the sea, and are lost beneath the water; rising, however, occasionally into little islands, at some distance from the shore; thus indicating that this formation is probably extensive.

The beach, which forms the margin of the shore, about a mile below the village of West-Haven, presents an interesting phenomenon, the solution of which may be found in the rocky strata we have been describing. The beach is covered

with magnetic iron-sand, uncommonly pure, and very sensible of the magnet. It may be obtained in large quantities, and is used by the inhabitants of New-Haven for sanding paper, and sometimes for an ingredient in a firm and durable mortar.

The origin of the iron-sand we have mentioned appears to be this : the strata at this place seems to be decidedly chlorite slate, and abound in minute crystals of magnetic octahedral iron-ore. The sea lashes the rocks at every tide ; and in all probability, the same kind of strata continues extensively beneath the surface. The rock being one which is easily disintegrated, the iron is thus washed out, broken by friction, and by the flow of the waves thrown back upon the shore. It is not often, perhaps, that a geological fact admits of more satisfactory explanation.

There can be little doubt that the extensive strata are primitive ; and it is very probable that the contiguous green-stone is primitive likewise. Its structure, is considerably different from that of the secondary green-stone, described above. It is much more porphyritic, and it frequently contains numerous crystals of white feldspar, of considerable size. In some instances it alternates with the schistose strata ; and no observations hitherto made will justify the conclusion that these rocks, like the East and West Mountains, rest on sand-stone, or any other secondary rock.

Leaving the hills which immediately bound the plain of New-Haven, and proceeding westward to the great road leading to New-York, some additional facts may be noticed. Green-stone continues to be the prevailing rock of the country ; and for several miles, we cross extensive ridges of this rock, and of green-stone slate.

At the distance of five or six miles from New-Haven, strata of green-stone slate become very extensive and regular. Their direction is very nearly north-east and south-west ; and their dip is from 30 to 40 degrees.

The country here is filled with ridges, consisting chiefly

of green-stone slate, which look generally to the south-east. They have considerable chasms, or small valleys, between them, so as to resemble very much a series of billows, when the sea runs high.

To this general formation there is one remarkable and striking exception. About five miles west of New-Haven, commences a range of serpentine, common and noble, and mixed, more or less, with primitive lime-stone and bitterspath. As this range proceeds westward, the lime-stone predominates more and more over the serpentine; and soon the rock becomes primitive stratified lime-stone. This continues in the same direction, in nearly uninterrupted ridges, for three miles at least; and, as is asserted, several miles farther. Thus, a circumscribed space not exceeding one fourth of a mile in breadth, and running in length, as has just been specified, intervenes between ridges of green-stone, and even in some instances, alternates with it; this rock, forming its boundary on the north, and also on the south, and in some places coming into direct and visible contact with it.

These strata of lime-stone are remarkably regular. Their direction and distance is the same with that of the green-stone slate. In a few instances, the lime-stone is interrupted by green-stone, and chlorite slate.

A quarry has recently been opened in these calcareous strata, for the purpose of obtaining marble; for the lime-stone, which has been mentioned, appears properly to deserve that name.

The structure of the rock is schistose. Its texture is minutely granular: its prevailing colour is that of the Italian dove marble, but very much variegated by innumerable veins of calcareous spar, or bitterspath, of a very pure and brilliant white, by an admixture of serpentine, forming green spots, and by black spots and clouds, which sometimes are magnetic iron ore, and sometimes appear to be serpentine, of a dark hue. Marble also, occurs here, of a deep black, beautifully illuminated by white

clouds. As far as the investigation has gone, these calcareous strata are divided into large distinct tables ; so that they can be taken out, in many instances, without making any other fracture than what exists naturally. Pieces of this marble have been sawn and polished ; and although only weathered pieces have hitherto been tried, the stone exhibits so fine a texture, so high a lustre, and such beautiful delineations of colour, as justify the belief that as a marble, it will prove a useful acquisition to the country.\*

It lies immediately upon navigable water, which, at the distance of two miles, communicates directly with Milford Harbour and Long-Island Sound, and is sufficiently copious to work the mills necessary for sawing it.

Serpentine occurs in this range, in various places ; and it appears to be indeterminately mixed with the marble in various proportions, so as to give the beauties of colour belonging to each. The serpentine, which is found at the eastern end of this range, is principally yellow and green, marked with numerous shades, clouds, and veins, arising from the admixture of magnetic iron ore, and other substances. It admits of a handsome polish, and is very beautiful. The noble serpentine which is found in it is of a very deep green, mixed with yellow, and is susceptible of so high a polish as to become a perfect mirror.

Green Talc, resembling French chalk, is sometimes to be met with between the strata of lime-stone.

Asbestos is abundant in this range, existing chiefly in the serpentine, and is very handsome. Its colours are various shades of white, blended with green. It is intermixed with bitterspath, and contains numerous pieces, and sometimes large ones, of magnetic iron ore. Amianthus is also found here, in some instances, nearly as fine as that of Corsica.

A considerable number of other minerals are found in this vicinity. Steatite, or lamellar Talc, occurs near the marble, and is used by the inhabitants as a substitute for chalk.

\* The discoverer of this marble was Mr. Solomon Baldwin, a student of Yale College.

Fine specimens of Tremolite, Common, Asbestos, and Glassy, are found in rocks composed of Dolomite and Quartz.

Epidote is very abundant in this region. It exists chiefly in veins, in green-stone, slate, and other rocks, and is sometimes massive ; but handsome specimens of a radiated structure have been obtained in calcareous veins, running through green-stone slate.

Chlorite is frequently found ; sometimes penetrating calcareous spar and quartz, and sometimes in veins, in green-stone-slate, and other schistose rocks.

Actinolite occurs in green-stone, which often contains micaceous magnetic iron ore.

Phosphate of lime is sometimes found in detached nodules of granite, in the neighbourhood of the marble.

Jasper, flint, red and common quartz, pudding-stone, and pitch-stone, are considerably abundant in this region.

Iron pyrites is found, both massive and in cubical crystals.

Lead, in the form of Galena, has been repeatedly discovered. A few years since, several hundred weight were found within half a mile of the range of serpentine, and repeated attempts were made to mine for it ; but it was not sufficiently abundant to prove profitable. Lead has also been found in small quantities, in several places, within a few miles of this.

P. S. Although not within the province of this essay, it may not be amiss to preserve in this place the memory of a curious fact concerning the discovery of native copper, a few miles from this town. Copper is still known to exist in various places in the Hamden Hills, and attempts have been repeatedly made to work shafts for the purpose of obtaining the copper, but the business has never been prosecuted to effect.

The fact now to be mentioned, seems to justify the hope that at some future period, copper mines may be successfully worked in this vicinity.

The following account is taken from Mrs. Doolittle, of this town, the daughter of the person who discovered it. She relates, that her father, Mr. Josiah Todd, of North-Haven, when gathering fruit on the Hamden hills, discovered a mass of native copper, weighing about 90 pounds, which he obtained and preserved. It was lying on the surface of a flat rock, in some places adhering to it, and even running into its crevices. He, with several other persons, sought for more ; but as they, by their own confession, had superstitious fears respecting it, they probably did not make a very minute investigation, and no more was found.

This mass passed through several hands, and was finally obtained by the son-in-law of the discoverer, a copper-smith, who considered it as very free from alloy, and used it in the course of his business. It existed, and was used, within the remembrance of Mrs. Doolittle and her son, of this town, and a part of it even ten or fifteen years since. Unfortunately, no part of this interesting natural production can now be obtained, nor is the precise place of its discovery known.

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XXVI. *A Description of several Combinations of Lead, lately discovered at Northampton, addressed to the Editor. By WILLIAM MEADE, M. D.*

SIR,

WHEN I had the pleasure of exhibiting to you part of my collection of American minerals, I observed, that you were struck with a variety of interesting specimens which I had obtained from the neighbourhood of Northampton ; particularly those rare combinations of lead which are connected with the ore lately discovered at that place, the geolo-

gical description of which is so accurately given by professor Silliman, in your last number.

If a short description of those varieties which are scarce, is considered in any degree interesting, I take an early opportunity of communicating it for your information. I shall soon have the pleasure of presenting you with specimens of the sulphate, muriate, and molybdate of lead, such as I shall here describe ; at the same time I regret that I have not yet obtained these in such abundance as to afford sufficient quantity for a complete chemical analysis, without destroying the beauty of the specimen. I have only been able to sacrifice about thirty grains of the sulphate of lead, so as to satisfy myself that I was not mistaken as to its character. Indeed, the external characters are so well defined in them all, as to leave little doubt on the subject, even with the very limited knowledge of mineralogy which I profess to have.

#### SULPHATE OF LEAD.

*Colour*—perfectly white.

*Lustre*—vitreous, approaching to the diamond.

*Transparency*—in some parts translucent, in others, perfectly transparent.

*Fracture*—splintery.

*Hardness*—is easily scraped with a knife.

*Specific gravity*—6. 200.

Nitric acid has no action upon it.

It decrepitates before the blow-pipe, but when this ceases, and the flame is urged, the mass fuses, and it is very easily reduced into small globules of metallic lead.

It occurs crystallized in plates or tables, which are set on cubes of galena, and not unfrequently in cavities of quartz, which is the matrix of this ore.

It is easily distinguished from carbonate of lead, by its brilliant lustre, as well as its crystallization, and most particularly by its insolubility in acids.

MOLYBDATE OF LEAD.

*Colour*—dark wax yellow.

*Lustre*—none.

*Transparency*—none.

*Hardness*—brittle, and easily yields to the knife.

Soluble in nitric acid, without effervescence, and only when heated : decrepitates before the blow-pipe, and melts into a grey mass, which by urging the heat considerably, shews small globules of metallic lead, but is reduced with much more difficulty than either the sulphate or the carbonate ; from which circumstance, as well as its peculiar wax yellow colour, it may be distinguished from them. There is no difficulty of distinguishing it from the phosphate, as the native phosphate of lead is not reducible by the blow-pipe.

It occurs here in small tabular crystals, set on their edges in cavities of crystallized quartz, and frequently intersecting each other.

MURIATE, OR CARBONO. MURIATE OF LEAD.

*Colour*—very light green.

*Lustre and Transparency*—vitreous, and nearly transparent ; the edges of the crystal having nearly the lustre of a precious stone.

*Fracture*—glassy.

*Hardness*—brittle ; yields to the knife easily.

It is found crystallized on compact galena, in groups of a cubic form, terminated by tetrahedral pyramids.

When heated on charcoal, it melts into an orange coloured mass, through which, on urging the flame, small globules of metallic lead appear.

It is slightly acted upon by nitric acid when pulverized, but a small portion only of it is dissolved.

XXVII. *A description of the Cheechunk Spring, in the town of Goshen, Orange County, (N. Y.) by Dr. DAVID R. ARNELL.*

**T**HIS spring, which has for a number of years past obtained and held some celebrity for its medicinal properties, is situated about three miles west from the village of Goshen, in a hollow, surrounded with hills on all sides except the north, where a small stream constantly issues from it, and runs into a swamp or bog meadow, of about eight or ten acres ; the leaves, soil and stones along the stream for about eight rods, are covered with a ferruginous crust : several other springs are seen issuing from under the hills into the bog meadow, none of which have any mineral impregnations or appearances. There are no calcareous rocks or stones in the neighbourhood of the spring which can be discovered, and the soil around it is a light gravel.

Several experiments were made upon the water, the most material of which show the following results, viz.

Expt. 1st. With a tincture of galls, the water turned black immediately, and upon evaporation, left a black ferruginous sediment.

2nd. With equal parts of lime water it soon became turbid, and after standing some time, deposited a sediment which appeared to be carbonate of iron, and carbonate of lime.

In this experiment, the water, after standing about two hours, gave out all its sediment, which was considerable, and in a few days a crust was raised on the surface of the water, which was simple carbonate of lime, without any of the iron ; this was in some measure produced by that portion of the external air which was received into the vessel through the cork, after standing a considerable time.

3d. With tincture of turmeric it changed to a reddish brown.

Expts. 4, 5 and 6. No change was produced by the addition of potash water, nor sulphuric or nitric acid.

7th. The temperature of the water in the spring is at 48°, of Fahrenheit's thermometer.

From these experiments it appears, that the water contains carbonate of iron and carbonic acid gas, in which it only differs from common water.

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XXVIII. *On the deoxidation of Potash: by*  
*Mr. GEORGE CHILTON.*

THE deoxidation of potash by iron, has excited considerable attention among the professors and practical chemists of this country: some of whom having failed in their attempts to obtain potassium, were inclined to regard the experiment as doubtful and capricious: and it is even said that Professor Davy, at the Royal Institution, very seldom succeeds. These circumstances did not fail to renew the desire I had long intended to gratify, of attempting the reduction of potash in this way, but which had been neglected partly, at least, from the expense of the apparatus. Economy led me to think of substituting something more simple, and cheaper than the bent tubes in common use. It occurred to me that as potash is volatilized at a white heat, it would pervade the capacity of a straight tube as completely as it would that of a bent one, and would, therefore, be as much exposed to the action of the iron turnings destined to abstract its oxygen. Following this obvious idea, I took three pieces of straight tube, one of which was the thick end of a musket-barrel. Into this piece I ground the other two, air tight, one at each end. The middle piece was filled with iron turnings, coated and placed in a temporary furnace, consisting of a few bricks, laid together on the hearth of a smith's forge.

A small inclination was given, in the grinding, to one of the pieces, to allow of the easy flow of the melted potash. The other, intended to receive the condensed potassium, was fur-

nished with a glass tube and stop-cock in the usual way. The experiment succeeded. On taking the apparatus to pieces, the end of the potassium tube presented potash, blackened by oxide of iron. This being removed, other matter appeared: but, being as anxious to ascertain the existence of potassium as to collect it, a little water was dropped into the tube, which was followed by an explosion, and considerable heat. A little more produced a second explosion, attended with flame, which issued to the distance of six or seven inches from the end of the tube. The experiment was repeated, with the difference of using card-teeth, instead of iron turnings, and was successful. A quantity of potassium was collected, but in this second experiment the tube was completely fused. These experiments were made on the 24th and 26th days of August.

My present apparatus is more simple, consisting of two pieces only. It is formed by cutting off a piece about 15 inches long, from the muzzle of a musket-barrel, and grinding it into the breech. This piece is intended for the potassium tube. The turnings are put next to it, in the longer piece, part of which projects out of the furnace to receive the potash, after the turnings have been brought to a white heat. The simplest apparatus for a single experiment is a straight musket-barrel, which may be had generally, for seventy-five cents: and as it must be cut, to get out the product of the experiment, it may be converted into the one alluded to in fig. 2.

#### REMARKS.

1. It appears to be of consequence that the tubes should be clean. This is easily accomplished when they are straight, by scrubbing them with sand and oil. The oil remaining in the corroded parts tends to the reduction of the oxide that may be lodged there.
2. The part exposed to the fire should have a refractory coat. Fire-clay and pounded porcelain are perhaps the best ma-

terials, as a mixture of fusible earths will promote the fusion of the tube.

3. The potash should be as dry as possible : but as it is difficult to prevent the absorption of moisture, the stopper may be left out during the fusion of the potash. The water will escape principally at that end of the apparatus. Or the potash may be fused in a silver spoon, on a red hot iron, and poured in.
4. The joint should be set up with a blunt chissel, luted, and kept cool, at the distance of about three inches from the fire. The tightness of this joint is very material.—I have since witnessed a failure, owing to a small leakage in this part, the luting of which had been neglected. The water used to cool the tube was drawn in, by capillary attraction, among the turnings, and produced a perpetual source of hydrogen.
5. The heat should be suddenly raised, which is readily accomplished by bellows. I was present at an experiment which failed, in consequence of a deficiency in the draught of an Accum's furnace. The turnings were oxidated before the necessary degree of heat was produced.
6. The iron turnings or card-teeth should exceed the potash in weight, as the affinity is doubtless aided by quantity.
7. The potash in my experiments was caustic, freed from foreign salts, and prepared by myself.

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*Plate I. Fig. II.*

- A. Potassium tube.
- B. Piece of musket barrel containing the turnings.
- C. Potash tube. D. Stopper of iron.
- E. Blast hole.
- F. Bricks constituting the furnace.
- G. Glass tube.
- H. Cup with oil.

*Plate I. Fig. III.*

- A. Potassium tube.
- B. c. Tube containing the turnings. The part at c. receives the potash without the furnace.
- D. Stopper of iron.
- E. Furnace of bricks.
- F. Blast hole.
- G. Glass tube.
- H. Cup with oil.

*Note.*—Apparatus for this experiment is cheaply fitted up by Mr. Woodworth, an ingenious mechanic at Greenwich.

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**XXIX.** *Observations and experiments on several Mineral Waters in the State of New-York. By Mr. JOHN GRISCOM.*

**I**N the course of a tour which I performed last summer to the northward, I sought for amusement, among other things, in the application of a few chemical tests which I carried with me, to the waters of several mineral springs which fell in my way. Some of these are well known as the resort of gaiety and fashion, as well as the temporary abode of the valetudinary, who seeks to relieve a distempered constitution by drinking freely of those salutiferous fountains, and breathing the mountain air which surrounds them.

A correct analysis of the water was in no case my object, as neither time nor convenience served me for the undertaking. The results, however, which were obtained, will not, I trust, be misplaced in the *Mineralogical Journal*, especially if the mention of them should offer inducements to any of its chemical readers to make further researches of this nature. The field of enquiry, as it respects our mineral waters, is undoubtedly wide and promising.

In passing up the North River, the water, on entering the

Highlands, was observed to become more limpid and colourless ; and on examining it by re-agents, opposite to West Point, I was surprised to find, that in a position so far below the reach of the tide, there was no indication whatever of marine salt. Nitrate of silver produced no discernible cloudiness ; nor was the water affected by any of the tests ordinarily used, excepting tincture of galls, and prussiate of potash. These occasioned a slight discolouration, arising no doubt from the presence of a small quantity of iron, as it is well known that this metal prevails in some of the adjacent mountains. Hence we may consider the waters of the Hudson in this neighbourhood, when not disturbed by uncommon tides, as a remarkably *pure*, though not a *strong* chalybeate ; and who knows but that the genius of humanity may direct, that the buildings, erected on the beautiful and commanding eminence of West Point, may in time become converted from the towers of Mars, into temples of Hygeia.

The approach to Lebanon Springs, a watering place on the borders of Connecticut, much frequented, amply compensated us for the perplexities incident to an obstinate coach-driver, and a pair of jaded Albany horses. Within a few miles of the spring, as we advance from the west, the beautiful valley of the Shakers opens on the right, presenting a landscape highly interesting from its natural variety, but more attractive from the luxuriance of its cultivation, and the unparalleled neatness which every where characterizes this singular people.

I did not learn that there were more than one spring which had obtained much notice. This is situated towards the summit of a high hill. From the portico of Hull's boarding house, erected on the spot, the eye has an extensive prospect of a country finely diversified with hills and vallies ; with native roughness and industrious cultivation. The spring is surrounded with a casement, and fills an excavation of about four feet in diameter, and three in depth.

The water is perfectly transparent, and what is very re-

markable, flows from the spring so copiously, as, with a little management, to turn an overshot mill, situated at some distance below. Adjoining the spring, plunging and shower baths are provided for the convenience of visitors. In this respect, the water is highly esteemed; one of its most striking qualities being a peculiar softness, when applied to the skin. It is also a thermal water: the temperature, examined by a good thermometer, on the 11th of August, was 73° Far. while in the open air the mercury rose to above 80.\* It preserves nearly the same temperature, I was informed, under all changes of atmosphere, throughout the year.

The water has nothing very peculiar in taste or smell. Small quantities of air are continually emitted from the surface of the spring, some of which being collected and tried, appeared to be little else than common air, with a mixture of carbonic acid.

*Sulphuric Acid*, added to the water, produced a considerable discharge of minute air bubbles, which, with other appearances and trials, indicate the presence of carbonic acid.

*Acetate of Lead*, occasioned an immediate precipitate, shewing the existence of sulphur as an ingredient of the spring. The water, in flowing down the hill, deposits the sulphur in considerable quantity.

*Nitrate of Silver*, caused a cloudiness, which exposed to the sun became dark; hence, the presence of a muriatic salt is obvious.—Probably common salt.

*Oxalate of Ammonia* proves that the water contains lime, in considerable quantity.

*Muriate of Barytes* yields a discolouration, shewing that a sulphuric salt is also present.

*Litmus*, *Prussiate of Potash* and *Galls* have no effect.

From these trials it may be inferred that sulphur, lime, a little fixed air, and a small proportion of muriatic and sulphuric salts are the chief constituents of the Lebanon water. There are strong inducements, however, for a belief that magnesia forms one of the principal bases of its saline ingre-

dients, as this earth is found in great quantity in the rocks around the spring. It is this (we may conclude) which communicates to the water its soft and pleasant feel.

On the whole, although this spring does not possess any strong medicinal virtues, yet as a pure and wholesome water; as finely adapted to the purposes of bathing; and from its situation in a place which possesses many local attractions, it is well worthy the attention of those who travel either for health or amusement.

During a short stay in the pleasant and thriving village of Troy, I was conducted to a spring on the declivity of the hill east of the town, which was supposed to be efficacious in some complaints, particularly in those of a cutaneous nature. From its strong smell, the dense precipitate found with the *acetate of lead*, and other indications, it proved to be a hepatic water of no inconsiderable strength. If kept in proper order, it may turn out to be of much local importance.

Among the mineral waters most remarkable for their strong saline impregnation, and active medicinal qualities, which this or any other country affords, those of Ballston and Saratoga hold an eminent rank. Being arrived at the former place, I was solicitous to ascertain how far a trial of my several re-agents, applied to the water drawn immediately from the spring, would confirm or contradict the accounts given by others.

The following are the results as noted down on the spot.

#### PUBLIC SPRING AT BALLSTON.

*Sulphuric Acid* produced a copious disengagement of fixed air.

*Muriatic Acid* the same, in a less degree.

*Oxalic Acid*, an immediate precipitation of oxalate of lime.

*Oxalate of Ammonia*, a more dense precipitate than the preceding.

*Prussiate of Potash* afforded, by a change of colour, evident signs of iron.

*Tincture of Turmeric* underwent little or no change.

*Litmus Water* was not much changed by the fresh water of the spring.

*Caustic Ammonia* combined with the fixed air, and yielded a precipitate of the carbonate of ammonia.

*Nitrate of Silver*, a very copious precipitate.

*Muriate of Barytes* produced no sensible effect.

*Lime Water*, a turbidness by the formation of the carbonate.

*Acetate of lead* afforded a dense precipitate.

The water at Low's spring was also examined, and agreed in every particular with the above, excepting that it appeared to be less highly charged with free carbonic acid, and to contain rather more iron.

The temperature of the water at Low's was 52,<sup>o</sup> and that at the public spring 50,<sup>o</sup> while the thermometer in the shade stood at 62.<sup>o</sup>

I scarcely need mention, that those waters generally prove diuretic, sometimes laxative, and sometimes powerfully astringent. They exhilarate the spirits, most probably from the unusual portion of fixed air which they hold in solution. The quantity which may be taken at once without injury is surprising. Twenty tumblers of common size are drank by some invalids before breakfast.

A man whom I found at the public spring, and who resided in the neighbourhood, informed me, about the middle of the forenoon, that he had taken twenty-seven glasses that morning, and that he had experienced from the use of those waters complete relief from a complication of diseases which had before baffled the skill of his physicians. So great was his confidence in their universal efficacy, he had brought a sick horse to partake with him; and the animal appeared (in reality) to be nearly as fond of the water as his master.

Several of the most noted springs at Saratoga were afterwards examined in the same manner as at Ballston, and indicated the like results, with this difference only, that the Saratoga waters, especially that of the Congress spring, are evidently much stronger in their alkaline qualities, and are more highly charged with fixed air, but weaker in their chalybeate property than the waters of Ballston. The addition of sulphuric acid to the water of Congress spring, produces a violent commotion, and most rapid discharge of fixed air; and it requires (as I ascertained) nearly one third as much of strong acid as of the water, to effect a saturation. About thirty gallons, I was told, afford upon evaporation one pound of salt, but I much doubt whether this is not greatly underrated. From three to six small tumblers, when the stomach is empty, operate freely as a cathartic. It is not a little remarkable, that while the water of these springs are thus loaded with foreign substances, the brook which flows by them, and within less than fifteen feet of Congress spring, is almost wholly free from any mineral tinge.

It may be seen by those who take the trouble to examine, that the results which I have mentioned, agree in every important circumstance with the valuable account given by Dr. Seaman in his "Dissertation on the Mineral Waters of Saratoga and Ballston."

To undertake to account for the changes which must necessarily take place beneath the surface, to produce those waters, is to attempt a problem of no small difficulty. The existence of iron pyrites along the borders of the brooks, and other places in the neighbourhood, in a state of partial decomposition, might lead to a supposition that the sulphate of iron thus found, being carried down by rains through various channels, came in contact, during its passage, with the carbonates of lime and magnesia, and a mutual decomposition of those substances taking place, (agreeably to the laws of compound affinity) the fresh water in flowing through those masses, would take up the several sub-

stances it is capable of dissolving, and rise with them to the surface. But the total absence of sulphuric salts in those waters, (as we must infer from the inactivity of the Barytic test) and the well known solubility of the sulphates of magnesia, soda, and lime, seem to destroy the probability of this theory. Neither are calcareous or magnesian stones found in the neighbourhood of the springs. The soil around the springs at Ballston is of a loose sand. At Saratoga, there are many rocks, but they are of a granite structure, in hardness approaching almost to that of porphyry. Whatever, therefore, be the means which nature employs in the production of those strong mineral solutions, it is highly probable that they are elaborated at a considerable distance from the places in which they are made accessible to human convenience. Dr. Seaman conjectures that the fixed air must be primarily evolved by the powerful action of subterranean heat upon calcareous matter, situated far beneath the surface; and he considers the temperature of the Lebanon spring as an indication of the presence of heat in this region. That this is a supposition as little liable to objection as any that can at present be formed I am not about to deny. I cannot, however, but think, that we are still too destitute of facts; that observation has not yet been sufficiently extended to the mineralogical structure of the country around the immediate vicinity of the springs, to frame any hypothesis that will satisfy the chemist: and yet there are but few questions more interesting to the naturalist, nor one whose solution would throw more light on the science of geology, than a rationale of the formation of such highly aerated and strongly saline springs.

I have lastly to observe, that in passing through Lake George, my attention was arrested, as must be that of every one who visits the lake, with the singular transparency and beautiful appearance of the water, by which rocks at the bottom are visible at the depth of twenty or more feet, and by which the angler may have the advantage of *sight*, as well as

feeling, to direct his judgment when to draw. About nine miles down the lake I examined the water with re-agents, and found that not one in the box had any visible effect upon it. I have been informed that some of the water of this lake has been transported to Europe, in order to be employed for holy purposes in the Catholic churches; and doubtless if a natural water, entirely free from earthly contamination, is particularly suitable for this purpose, none is likely to be more so than the water of Lake George.

New-York, 8th month, 31st, 1811.

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*XXX. Particulars relative to a late accidental explosion of Fulminating Silver, in the Chemical Laboratory at Yale College. Communicated by Mr. GRISCOM.*

**P**ROFESSOR SILLIMAN, of Yale College, having recently communicated to me (at my request) a particular account of a serious accident which befel him, while preparing fulminating silver, I conceive that the perusal of it will not only prove interesting to the readers of the Journal, but may possibly be the means of saving some other chemist from a similar misfortune. I have accordingly obtained his permission to send the following memorandum for insertion.

J. GRISCOM.

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Extract of a letter from B. Silliman to J. Griscom,  
dated October 24th, 1811.

“I was preparing the fulminating silver on the 2d of July last, and having sent away my chemical assistant for half an hour, I was entirely alone in my laboratory. My process was that with solid nitrate of silver, nitric acid and alcohol: the quantities fifty grains of the former, with half an ounce of each of the latter: the vessel, an open evaporating basin of wedgewood ware. I had so often prepared the fulminating silver in this manner without accident or dif-

ficulty, that I suppose I had insensibly begun to undervalue the danger, and had probably acquired a degree of that negligence which familiarity with critical operations is prone to produce.

“ In former instances, my uniform course has been to mix the ingredients abovementioned, when, if the acid be concentrated, and the alcohol well rectified, a rapid action immediately and spontaneously commences. If these reagents be such as are usually found in the shops, it is necessary to apply, for an instant only, a very gentle heat, such as that of a candle, which never failed to produce the action desired. This action consists in a lively ebullition, with red fumes of nitrous gas, (nitric oxyd) and the distinct odour of nitric æther. The grey powder of the lunar caustic (the nitrat of silver of the shops) soon disappeared, and in its place is seen a white powder, which is the fulminating preparation desired. Neither the vessel nor its contents were stirred, till cold water had been thrown in, in abundance, by which all further chemical action is arrested ; and the fulminating powder being obtained on a filter, is slowly and very cautiously dried upon a chalk stone, merely warm. Had I been contented still to pursue this, which I am sensible is the common course, all would have been well. But observing the fulminating powder to be already produced in abundance, and wishing to inspect the process more narrowly, I ventured to take the vessel up, while the ebullition was still going on rapidly. This I had never done before, but I now thought that the moist state of the powder would prevent any accident, as I had never known it to explode when wet. I turned the basin one way and another, and observing a little of the lunar caustic sticking to the bottom of the vessel, and apparently unchanged, I wished to detach it, that it might get into the mixture, and undergo the desired change. For this purpose I took a glass cylinder, and stirred the contents of the vessel, not without some anxiety, I confess. I had no goggles on, and, as no mischief happened, I grew

bolder, and insensibly brought my face within eighteen inches of the vessel, and my eyes directly over it. It was certainly very imprudent, but I relied on the wet state of the powder: probably some of it had become partially dried by the heat generated by the chemical action which was still rapid. I stirred it several times, but, at last it all exploded with instantaneous and dreadful violence, and the full force of the blow was received by my eyes, into which the remaining nitric acid and lunar caustic were powerfully driven. The explosion was heard in the remote parts of the neighbouring colleges, and excited enquiries as to what had occurred in the Laboratory. I was thrown into total blindness, with almost insupportable anguish in my eyes, and great distress in my head and whole system. I was stunned, but not entirely deprived of my reason. I was aware of my situation, and knew that my immediate resource must be in water. My first impression was that my eyes were torn in pieces. There was no water in the sink, the usual place, and in my attempts to reach the pneumatic cistern (my next resource) I ran over the furniture of the room. The cistern was encumbered with drawers of minerals, and it was some time before I could grope my way to the well of the cistern. Having washed my face and eyes, I made an attempt to separate the lids, and with great distress succeeded so far as dimly to discern surrounding objects; but the swelling and inflammation in a few minutes shut me in total darkness.

I got into the apparatus-room, and sat down faint and exhausted with pain; my assistant returned; medical and other assistance was procured, and I was carried home and shut up in dark rooms, during a painful and tedious confinement. No fragment of the vessel hit me, and I had to contend with the corrosion of the caustic materials, and with the still more serious effects of the violent concussion. A copious flow of tears during several days and nights washed out the acid and caustic, and every means of reduction, viz general and topical bleedings; the latter principally, by cu

ping and leeches : cathartics, blisters, low diet, darkness and inactivity, gradually subdued the inflammation, and now, at the end of almost four months, I find my eyes restored to distinctness of vision, but still very weak compared with their former state. I was partially salivated by the fumes of the silver, and my general health was much reduced by the accident, and treatment. My error was in stirring the mixture, and this had nearly proved fatal. I conceive it happy that I had no goggles on, for the glass would probably have been shattered and driven into my eyes."

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## PUBLICATIONS.

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### COAL.

THE price of fuel has of late increased to such a degree as to become alarming to all classes of citizens. This is in great measure owing to our supplies of coal from Great Britain, whence so much of that valuable article has hitherto annually been imported into this country, being interrupted by the present state of our political affairs. Should this embarrassment continue for any considerable length of time, our stock of wood must necessarily decrease rapidly, as the immense quantities used in our great cities, must, ere long, entirely exhaust our already greatly thinned forests. It is a fact well known to every one, that the price of wood has certainly more than doubled within the last twenty years.

With the view of correcting this growing evil, recourse must be had either to replenishing our stock of wood by *planting*, or our attention must be directed to *exploring for coal*, of which there is doubtless plenty to be found in our extensive territory. It is under the impression that every information relative to the search after coal, will be considered as useful, particularly at the present period, that we are induced to lay before our readers the following copious extract

from *Williams' Natural History of the Mineral Kingdom*, a second edition of which work has lately appeared, greatly improved, by Dr. James Millar, of Edinburgh.

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“ OF THE INDICATIONS OF COAL, AND METHODS OF  
SEARCHING FOR IT.

“ IT appears to me a matter of importance, that the indications and external appearances of coal should be known, especially by those who have landed property in coal countries. Many such, I have no doubt, will be glad to have the true and infallible symptoms of coal pointed out to them, and distinguished from those that are false and doubtful.

“ Some whose estates lie contiguous to certain coal-fields, will no doubt have coal in their own grounds, and others will be confident they have coals, whether it really be so or not ; for it frequently happens that those who are wrong, or ought to doubt, are nevertheless the most confident. I will, therefore, for the instruction of all concerned, make some inquiries about the appearances of coal, and I will carefully endeavour to distinguish the true and infallible from the false and doubtful indications. It may be said with truth, that coal itself, in some form or other, is the most infallible appearance of coal : but this is too general.

“ It being understood that the one side at least, if not both sides of every seam of coal, rises up to the surface of the globe, and crops out somewhere, it is our business to go to such places where the superficies of the strata have a chance of being discovered ; as, for instance, to the rivers, rivulets, gullies, rocks, and ditches, in some of which may be had a view of the prevailing strata of the country ; and if they be of the class of coal metals, we are so far encouraged to proceed.

“ I have here to observe, that there may be, and certainly  
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distance from the real and solid crop of the coal where the seam is to be found betwixt roof and pavement, even upon level ground ; and where there is less or more declivity, it then spreads still farther from the solid stratum.

“ I have frequently seen the vestigia or appearance of a thick seam of coal spread upon the surface, beneath the upper soil, twenty or thirty yards from the real seam, where the surface of the ground had a considerable declivity. The side of this vestige or appearance of coal next the solid seam is sometimes as thick as the seam itself ; but it gradually wears thinner and thinner as it recedes or spreads away farther from the seam ; and it also grows worse, and worse, or the more unlike coal, the farther from the seam. The side of this vestige next the solid stratum, chiefly consists of the debris or rubbish of coal broken small. A little farther from the seam, it consists of very small grains of coal mixed with a black soot-like matter ; and still farther, nothing appears but sooty matter, resembling black friable earth or clay, especially if there is any clay either in the soil or under it ; and at the extremity of the vestige, I have seen it dwindled away to an inch or less, of a blackish soft substance, like a thin stratum of clay. Where the surface of the ground has the least declivity, the vestige or appearance of coal is sure to spread downwards from the seam, be the slope of the strata which way it will ; and the greater the declivity of the surface, the farther down we may expect to find the extremity of the vestige.

“ When a coal crops out upon level ground, we shall not find the vestige of it spread out so far from the seam as upon a declivity ; and in this, it will not be found so thin at the extremity upon a plane as upon a declivity. When a stratum of coal crops out upon a plane or level field, there is one remark to be made concerning the vestige of it, which is different from the declivity. Upon a plane, the vestige of the coal always spreads out in a line right forward from the declivity or rise of the seam of coal.

“ But I must be more explicit. Let us suppose, then, that

that the stratum of coal declines or dips with an easy slope towards the south-east : in that case, the rise or acclivity of the seam is towards the north-west, so that the vestige of the coal will be found a little way from the solid seam farther towards the north west : and, therefore, when a vestige of coal so inclining is found upon level ground, and you have cut through it, and found different soils below, you must then turn your face towards the south-east, and dig away in the vestige, keeping your cut down to the clay or rock, or whatever matter you find immediately below the vestige of the coal ; and by following the appearance of coal towards the real dip of the seam, it will not be long before you will find it solid between roof and pavement.

“ This circumstance of the vestige or crop of the coal spreading forward in a line with the acclivity of the seam, makes the knowledge of the declivity of the strata in that place very necessary, as without it you do not know which way to push or advance forward with your trial for the coal, although you should find a flattering appearance of it. But in discovering some appearance of coal upon an inclining plane field, or in the side of a glen or dingle, or any other description of sloping ground, the case is quite different. To whatever point of the compass the dip and rise of the strata should happen to be, the vestige of the coal is sure to slide down the slope of the ground, and we are sure to find it spread thin in proportion to the precipitance of the slope, and the distance from the solid crop of the seam of coal.

“ In searching for coal, it is necessary, in the first place, to be well acquainted with the appearances and characters of the various concomitant strata : and, secondly, to be acquainted with the various symptoms and indications of a seam of coal, which I have now under consideration. Having acquired these two branches of knowledge, the next thing to be done is, to examine carefully all the ravines, gullies, rivulets, scars, and ditches in the grounds, with such rocks and precipices and other places where the superficies

of the strata may be seen. It is in these scenes that we discover what the solid superficies of our globe is composed of; and the variety which we behold, and the discoveries which we make, are a never-failing source of pleasure and entertainment to an inquisitive and intelligent mind; and it is in these broken scenes of nature that we have the greatest chance of making mineral discoveries of various kinds, and particularly discoveries of coals and quarries.

“ Sometimes the crop and bearing of strata of coal run parallel to one of these ravines or gullies for a considerable length of ground, and sometimes they cross the glen or dingle in a right or a diagonal direction. When a stratum of coal crosses a glen in any angle whatever, there is a probability of discovering the crop of the seam, or some indications of it, either in the bed of the rivulet or upon one side of it.

“ It is not uncommon, in some places in coal countries, to find the superficies of the strata washed clean by a river or rivulet; that is, to find the seam or stratum of coal in its proper regular position in the solid superficies of the strata, at full thickness and in perfect form betwixt roof and pavement, dipping towards the same point with the ordinary declivity of the strata in that place: But it is more common to discover in such places only some appearances of coal, which frequently require knowledge and acuteness to discern, with skill and judgment to make a proper use of the discovery.

“ I have all along, in this history, inculcated the necessity of some proficiency in the natural history of the various strata which compose the structure of the superficies of our globe, in order to qualify us for researches of this kind. In the present case, it is necessary to have some knowledge of the bearing and declivity of the strata, in the place where any indications of coal are found, before we can form any judgment of the discovery, and know how to make a proper use of it.

“ When a seam of coal runs parallel to a glen or gully, and

crops out any where within the banks upon one side or the other, there is a great chance of discovering some indications of the coal, perhaps in several places as you advance up or down the glen.

“ I have shown already, that the outburst, or superficial vestigia of a stratum of coal, upon a slope, is always found to slide downwards, and that the longer and more precipitate the slope is, the farther down the vestige will slide when the crop of the seam happens to be high up. I have also shown, that the extremity of the vestige of a coal seam at the surface is sometimes converted into a soft sooty substance, hardly distinguishable from a thin stratum of black clay or earth ; but this is not always the case. The debris of some of the splent and cannel coals frequently remain in hard and sharp masses of various sizes, even when mixed with the soil, and removed at some distance from the solid crop of the seam ; and some of the cherry coals, or *rock coals*, as they are called in Scotland, do not dissolve upon the surface into an undistinguishable mass, like a friable clay ; but, on the contrary, although the debris, or coal rubbish, at the surface, should be broken very small, yet there will be found some sharp angular grains and bits of coal, of the size of peas, nuts, and plumbs. In places where seams of coal crop out, some appearance of the coal will be seen, by an observing skilful eye, in such glens as we have been speaking of ; and sometimes masses of splent or parrot (*i. e.* cannel coal), of a larger size, are found upon the side, or at the bottom of a ravine, which have slipt down by degrees from the crop of a seam of coal situated above.

“ From these inquiries it appears, that the vestigia and appearances of the outburst or crops of different seams of coal, are of three sorts : 1<sup>st</sup>, Pretty large masses of hard coal, not so apt to dissolve when exposed to the influence of the external air : 2<sup>d</sup>, Smaller masses and grains of cherry coal, of a diced or cubic form, which is frequently mixed with a soot-like coal dust : And, 3<sup>d</sup>, Coal dust, without any

visible grains and masses, sometimes resembling soot, and sometimes hardly distinguishable from a blackish or dark brown friable earth. These particles of coal are frequently found mixed with the upper soil upon the side or at the bottom of a glen or gully ; and sometimes they appear under the upper soil, upon the face of the rock, in some break or scar.

“ When these appearances are discovered within the banks of a ravine or glen, the first thing to be done is, to go to a place where the superficies of the strata are to be seen in the same glen, and to examine the points of the compass towards which the strata trend, and incline or dip ; and when these points are ascertained, you will be enabled to know whether the strata run parallel to, or cross the glen where the appearance is found. If the bearing of the strata is either parallel, or nearly parallel, to the trending of the sides of the glen, you can easily discover the seam of coal by digging small bits, at a proper distance from one another, cutting through the vestigia of coal, and in a line up the slope ; and if the last of these, that is, the uppermost, should happen to have no vestige of coal, it is very probable that you have overshot the seam, and in that case you must go back to the next pitting in which the appearance of coal was found, and dig a cross cut in a line upwards, and you cannot fail to cut the surface or crop of the seam of coal, if you dig to the face of the rock or solid strata. If the bearing of the strata crosses the glen, either at right angles or in a diagonal direction, your digging then must be directed across the course and bearing of the strata ; and perhaps in this case it may be more proper to dig a trench, in a line from the place where the vestige of coal is found, than to make pits ; the trench to run across the bearing of the strata : But of this those who are upon the spot must judge which method of trial is best, as circumstances vary considerably in different places.

“ But it frequently happens that the superficies of the strata are not to be seen in several places : in many glens the face

of the solids being often concealed under a deep or thick cover of gravel, sand, or clay.

It is very common in a coal country to find banks or beds of small gravel, and likewise beds of sand and clay, mixed with small masses of coal of various sizes, which indeed is an indication of being in a coal country ; but such bits of coal so found are no indication of a seam of coal in this place : nevertheless a seam, or seams, of coal may be there, but the bits of coal lodged in the banks of sand or clay are not the vestigia of them, as these masses of coal have been carried there when the rest of the sand or clay with which they are blended was deposited ; and, therefore, it is necessary, when you find small masses and grains of coal, to be able to judge whether they are mixed with the natural soil, or in adventitious beds or banks of gravel, sand, or clay. If amongst adventitious matter, you need not dig, unless you have some other more certain indications of a seam of coal being near.

Of all the beds and banks of adventitious matter which are found above, and conceal the superficies of solid strata from view, clay is the most common in coal countries. Though it frequently happens that we have to dig through sand or gravel in sinking coal-pits, yet we more frequently sink through clay ; and of all the species of clay, a strong, hard, and dry clay, mixed with less or more of sand, gravel, or stones, is the most common in coal-fields. When this species of clay is blended with boulders and bullets, with some gravel and sand, it is frequently very strong and dry and almost as hard as a rock. In some places this species of compounded cover-clay contains specimens of all the strata found in the neighbourhood ; and when it is of this sort, which may be called a general composition, it is frequently a very curious and a very confused mass of indigested matter. Grains, masses, and fragments of every species, quality, and colour of the strata to be found in that country, are promiscuously blended in this heterogeneous species of clay.

There are in some places vast beds and banks of these compounded clays, which cover and effectually conceal the superficies of the strata for a considerable extent; sometimes over the whole face of an extensive neighbourhood, excepting where it happens to be cut through by a strong current of water; but it is sometimes so hard that the strongest currents are not able to wear it through. I have in many places seen this species of clay from a yard up to thirty or forty yards deep, and more, above the rock or superficies of the strata; and, as I hinted above, it frequently contains specimens of the coal, and of all other strata found in the neighbourhood. I have often seen such a quantity of larger and smaller masses of coal blended in this sort of clay in some particular places, as might deceive many, and make them imagine that it was the vestige of the crop of a seam of coal.

I know that many do imagine it, and I have no doubt that several will be induced, from the quantity and variety of bits of coal found in different places in this clay, to make some trial in it; and for such as are not very well acquainted with this composition, perhaps it would be wrong to dissuade them altogether from digging a little in it, because it is in some instances pretty difficult to distinguish between the vestige of the crop of a seam of coal, and a nest of bits and grains of coal blended in the compound clay; especially when we consider and know that a real outburst of the crop of a coal is frequently mixed with clay at the surface of the ground; and, therefore, when appearances are so doubtful that it cannot be distinguished with certainty whether the masses and grains of coal which are found, be the vestige of a seam or adventitious, it may be proper to dig a little. If the appearance of coal, upon which the trial is made, be adventitious, and belonging to the compound clays, the symptoms will not alter much upon digging in it, there being sometimes a great depth of this clay above the superficies of the solid strata, so that there will be no material change in

digging. No appearance of a stratum of coal will be found; nothing but the same compounded clay continuing with adventitious grains and masses of coal in it, which coal is part of the composition; and the whole mass of the clay, as well as the coal, is adventitious.

I hinted before that it is the character of some beds of this clay to be compounded of specimens of all the neighbouring strata; and in fact, these specimens, and the whole of this composition, have been torn off the surfaces of the strata by water, soon after they were formed, before induration was complete; and the matter so torn off was carried forward a little by the weight and force of the high tides, and when the tides began to abate, and fall lower and weaker, these beds of clay were left as we find them, when the weight and force of the water failed.

Thenumerous hillocks and extensive beds of gravel which we see in so many places upon the face of the earth, have the same origin. Those gravel beds and banks are also a composition of various species of such strata as were indurated, and they were likewise torn off the rocks; and after being rolled in the waters until all the asperities and sharp angles were worn off, the whole was lodged as we find it.

As several of these beds of compound clay contain specimens of all the strata of the neighbourhood, which may be easily proved by comparing the specimens with the strata from which they were broken off, and as coal is a part of this composition, I give this as another symptom or indication of coal, which may be called an infallible one. I cannot, it is true, by seeing this symptom of coal, pretend to say there is a seam of coal within so many yards, or within so many hundred yards; I have nevertheless, no difficulty to assert that there is coal in the neighbourhood where this compounded clay appears with masses and grains of coal in the composition.

I have been thus explicit in pointing out the difference be-

tween small masses of coal discovered in the compound clay, and the real vestige of the crop of a seam of coal, for the information of such as cannot yet perfectly distinguish the one from the other.

After this explanation of the origin, appearance, and component parts of these beds of ~~compound~~ clay which so frequently conceal the superficies of the strata from our view, I hope that all who are interested, and even such as are not adepts in this science, will be able to distinguish between small masses or bits of coal found in beds of clay, and such as belong to the real outburst or crop of a seam of coal; and in cases where they are not certain at first, and resolve to dig, they will soon be able to distinguish between the vestige of the crop of a seam, which is generally continued, and increases from the first discovery, until we find the crop of the seam betwixt roof and pavement; whereas the bits found blended in the compound clay are generally detached from one another, are imbedded in a vast mass of clay, without any continued stratum or vestige which might lead to a seam of coal; and, therefore, when digging proceeds in a bed of this species of clay, it will be needless to proceed, there being no hopes of making any discovery in it.

There is one circumstance yet to be remarked; The masses and bits found in the compound clay are generally hard, clear, and perfect; whereas the bits found in the vestige of the crop of a seam of coal have frequently a decayed imperfect appearance, sometimes quite decomposed or dissolved into dust, resembling soot or black earth; and where there are small masses of coal, they are generally tender and friable, and blended with coal dust, excepting in the case of the seam of coal containing a stratum of hard parrot or splent, as these sometimes produce pretty large masses, which have fallen down the slope, or scattered about the surface, at a considerable distance from the crop of the seam of coal. These larger masses frequently appear in considerable degrees of perfec-

tion, without any other vestige of coal, at a distance from the seam, though other vestiges may be found nearer to it. Masses of cannel and hard splent coal bear tumbling about, and they bear the external influence and changes of the air without injury as well as some stones; but all the cherry coals, roch coals, and some of the splents, decompose at the surface, and fall either to dust or to small grains; and it frequently happens that some parts of the same stratum of coal dissolves to powder, and other parts of it fall down into small pieces, or to grains and bits of various sizes; and these are found blended together either upon the surface of the ground, or under the cover-clay or other matter.

I observed before, that the appearance of coal is sometimes so near the surface as to be discovered by the spade and by the plough; and I have frequently seen small bits or grains of coal mixed with the soil cast up by the mole, when the superficies of the strata happened to rise to the surface of the ground. But when bits or grains of coal are cast up by the plough or by the mole, it should be considered and judged whether such grains of coal are adventitious, or belong to the vestige and crop of a seam.

Coal has been laid down in a vast number of places upon the face of the earth for burning lime and bricks, and for many other purposes, and a quantity of the small debris of it will remain; and, moreover, where coal is burnt for common fuel, a quantity of the debris of it is carried out with the ashes and spread over the fields. In these cases, bits and grains of adventitious coal will appear after the plough, and in the mole hillocks, where no seam is to be found.

I have already recommended an examination of the glens and rivulets, and all other places where the superficies of the strata may be seen which are likely places for discovering strata of coal.

It generally happens in all coal-fields or coal-countries, that the superficies or outburst of a great number of seams of coal

are to be seen in such places ; but of all the places where coals are discovered, new-made ditches are the most remarkable. However, it must be noted, that no mineral discoveries of any kind can be made in ditches, by forming roads, or by any other superficial methods of digging, where a thick bed of clay, or a bed of gravel or sand, covers the superficies of the strata ; but where the rock or strata come up so high as to be found immediately below the upper soil, or under a very thin bed of surface clay, the vestige of coal is frequently thrown up by ditching.

I need not observe here, that the symptoms or indications of coal appear in ditches by black strokes across the dyke or bank thrown up out of the ditch, which strokes or stripes are sometimes discernible at a considerable distance.

When ditches are cut across the crop of a seam of coal, they throw up a quantity of black matter upon the top of the dyke, which generally appears obvious ; but the vestige of coal so thrown up is not always distinguishable at first sight from the vestige or crop of blaes, and all the black coal tills. The one is generally as black as the other to appearance, and, therefore, circumstances must be well examined.

If a quantity of black argillaceous matter is dug through and thrown up, without any bits or grains of coal appearing in it upon examination, then it may be concluded that blaes or some species of black coal till have been only cut through ; but if any bits or grains of coal are found, some trial should be made by digging.

I hinted before, that the extremity of the vestige of a seam of coal is sometimes no better in appearance than an inch or two of black clay or earth. When such a faint and obscure appearance is found in cutting ditches, it should be narrowly inspected, to see if any symptom of coal can be found in it, such as small grains of coal, or if it be of a friable quality and appearance, like wet coal dust. In this doubtful case you should dig a little in it, following the vestige towards the ae-

clivity, if the ground is sloping; but if it is a perfect plane, towards the strongest side of the vestige, and if a seam of coal crops out there, and if you are digging towards it, the vestige of the coal will increase, and grow more and more like coal as you advance towards the seam, and grains of coal will appear, which will encourage you to go on with your trial.

But the vestige of coal discovered in cutting ditches is not always so obscure. It is very common for a quantity of coal to be thrown up with the spade, which may be seen in grains and small masses upon the top of the dyke, especially after a shower of rain; and it sometimes happens that the crop of the coal is so near the surface of the ground, that the real superficies of the seam is cut through in the ditch, and small coal with the spade is thrown up in great abundance.

When the vestige of a seam of coal is once discovered in a ditch, or in any other place or situation, it may be proper to make such trials upon it, by pitting towards the dip, or by following the vestige with a trench, as will trace the seam under cover in solid metals, or until the proprietor is satisfied. No true judgment can be formed of the thickness and quality of a stratum of coal, until it is found under the cover of solid metals, that is, until it is seen in the solid strata, between roof and pavement. When you have pursued the vestige of a coal until you have it within the solid strata, with a solid regular roof above, and a solid and regular pavement below it, you can then judge of its thickness, as it seldom alters much in thickness when you go farther down in it, and you can sometimes also judge of its quality. When you have a regular roof and pavement, you can judge of some of the characteristic qualities of the coal; you can then see whether it is clean or foul coal, that is, whether the coal is pure, and free of heterogenous matter, or if it is mixed and blended with pyrites, stone, or argillaceous matter; or if

there are beds of stone, blaes, &c. running in the middle of the seam of coal, and so dividing it into two or more strata: and sometimes you can judge, pretty near the crop or surface, whether it will be a hard or soft coal, and if it will prove a good burning coal or not; though you cannot always judge of these last mentioned qualities so near the surface, as some coals, which appear soft, tender, and useless when but a few fathoms below the surface, improve wonderfully in strength and quality at a greater depth, when under a great weight of superincumbent strata. Some seams of coal appear and burn pretty well when first found between roof and pavement, and others are good for nothing so near the surface, and unfit for use until they are under many fathoms of solid cover. This is very well known in experience, and generally the deeper down the better.

*On the Composition of Zeolite.* By JAMES SMITHSON,  
Esq. F. R. S.\*

**M**INERAL bodies being in fact, *native chemical preparations*, perfectly, analogous to those of the laboratory of art, it is only by chemical means that their species can be ascertained with any degree of certainty, especially under all the variations of mechanical state and intimate admixture with each other to which they are subject.

And accordingly we see those methods which profess to supercede the necessity of chemistry in mineralogy, and to decide upon the species of it by other means than hers, yet bringing an unavoidable tribute of homage to her superior powers, by turning to her for a solution of the difficulties which continually arise to them, and to obtain firm grounds to relinquish or adopt the conclusions to which the principles they employ lead them.

Zeolite and natrolite have been universally admitted to be species distinct from each other, from Mr. Klaproth having

\* From the Philosophical Transactions for 1811, Part I.

discovered a considerable quantity of soda and no lime in the composition of the latter, while Mr. Vauquelin had not found any portion of either of the fixed alkalis, but a considerable one of lime, in his analysis of zeolite.\*

The natrolite has been lately met with under a regular crystalline form, and this form appears to be perfectly similar to that of zeolite, but Mr. Haüy has not judged himself warranted by this circumstance to consider these two bodies as of the same species; because zeolite, he says, "does not contain an atom of soda."†

I had many years ago found soda in what I considered to be zeolites, which I had collected in the island of Staffa, having formed Glauber's salt by treating them with sulphuric acid; and I have since repeatedly ascertained the presence of the same principle in similar stones from various other places; and Dr. Hutton and Dr. Kennedy had likewise detected soda in bodies, to which they gave the name of zeolite.

There was, however, no certainty that the subjects of any of these experiments were of the same nature as what Mr. Vauquelin had examined, or were of that species which Mr. Haüy calls mesotype.

Mr. Haüy was so obliging as to send me lately some specimens of minerals. There happened to be amongst them a cluster of zeolite in rectangular tetrahedral prisms, terminated by obtuse tetrahedral pyramids whose faces coincided with those of the prism. These crystals were of a considerable size, and perfectly homogeneous, and labelled by himself "*Mesotype pyramidée du depart. du Puy de Dôme*. I availed myself of this very favourable opportunity, to ascertain whether the mesotype, of Mr. Haüy, and natrolite, did, or did not differ in their composition, and the results of the experiments have been entirely unfavour-

\* *Journal des Mines*, No. xliv.

† *Journal des Mines*, No. cl. Juin 1810, p. 458.

light or globe of fire attending them. One of the stones, which fell at Mortelle, it seems had not been found. Another fell at Villeroi, and the third at Moulinbrûle. One of them weighed twenty pounds, and made a hole in the ground, in a vertical direction, just big enough to bury itself, at the same time that it threw up the earth eight or ten feet high. This stone was taken out about half an hour afterwards, being still hot enough to be held in the hand with some difficulty. It diffused a strong scent like that of gunpowder, which it retained till it was perfectly cold. The second stone made a hole similar to the other, in a vertical direction, and being found 18 hours after its fall, was quite cold. These stones were irregular in their shape, and their angles in general obtuse: they contained rather more globules of iron than those that fell at l'Aigle, in Normandy; these globules are also rather larger, and the colour of the stone when first broken is somewhat clearer: it may be speedily oxyded, and is sufficiently dense and heavy to write upon glass. It is broken with difficulty. and comes to pieces very irregularly, and is very fine in the grain. Its exterior is about a quarter of a line in thickness, and its colour of a darkish grey. These stones are also traversed by some irregular black lines, strongly marked, from a half line to two lines thick, and which traverse them in a manner similar to the veins of certain rocks. Does not this fact seem to indicate that they existed prior to their fall, that they have been produced in the same manner as rocks, and were not formed in the atmosphere?"

[*Journal de Physique.*]

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A meteoric stone of the weight of fifteen pounds, fell to the earth on the 1st of March, 1811, in the village of Konleghowsk, dependant on the town of Romea, in the government of Tschernigoff, in Russia, and making part of the domains of Count Golovkin: its fall was preceded by three violent claps of thunder. When it was dug out from the depth of more than three feet, through a thick layer of ice, it still possessed heat: it was remarked, that at the third

clap of thunder, there was an extraordinary explosion, with a loud hissing noise, and throwing out a great quantity of sparks.  
[*Philosophical Magazine.*]

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PRIZE QUESTION CONCERNING THE NEW METALS.

Among the new Prize Questions lately proposed by the Royal Society of Sciences at Harlem, are the following: "Can it be demonstrated by uncontrovertible experiments that the substances which have the appearance of metals produced from alkaline salts are real metals? Or are there sufficient reasons to maintain that they are Hydrurets produced by a combination of Hydrogene with the Alkalies? What is the most certain and convenient mode of producing these substances from the Alkaline Salts in pretty considerable quantity by means of a high temperature?

[*Nicholson's Journal.*]

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VERMONT MARBLE.

*Extract of a letter from Professor Hall, of Middlebury College to the Editor.*

Marble of various qualities has been found in many places on the west side of the Green Mountains in Vermont. A few years since, a valuable quarry was discovered in Middlebury, a town situated on Otter Creek, eleven miles above Vergennes. The quarry forms one bank of the Creek, for several rods, and extends back into the side of a hill to a distance at present unknown. The stone lies in irregular strata, varying considerably in thickness, but all more or less inclined to the northwest. The marble is of different colours in different parts of the bed. On one side it is a pure white. I have compared pieces, taken from this part of the quarry, which has recently been opened, with specimens of the white marble brought from Italy, to which, I think, it is but little, if any, inferior. The white marble seems to constitute but a small portion of the whole mass. The colour, that predo-

minates through most parts of the quarry, is a grey of different intensities. The marble of both kinds is solid, compact, free from veins of quartz, and susceptible of an excellent polish.

A mill, of a peculiar construction, has been erected for the purpose of sawing the stone into slabs. It contains sixty-five saws, which are kept almost constantly in operation. During the years 1809 and 1810 these saws cut out twenty thousand feet of slabs, and the sales of marble tables, sideboards, tombstones, &c. in the same period amounted to about eleven thousand dollars.

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#### CRYSTALLIZED BODIES DISCOVERED IN METEORIC STONE.

*Extract of a letter from Col. Gibbs, to the Editor.*

In examining some of the meteoric stones which fell at Weston, I found imbedded in one of them a cubic crystal of Pyrites about 2-3ds of an inch over, and at one angle of it another like crystal. The pyrites has suffered more or less of decomposition, being generally of a dark grey colour, approaching to brown, hard, frangible, and is attracted by the magnet: a part of the broken surface has the metallic lustre. One surface of the cube is nearly preserved. This discovery proves the existence of crystallized bodies in the meteoric stones, which before had been only conjectured by Mr. Gillet de l'Aumont of Paris, a distinguished French mineralogist. (See *Journal des Mines*, vol 23.) I am happy to inform this gentleman, through your Journal, that I have been able to verify his conjectures, in remembering his former advice to search in our meteoric stone for crystallized substances. This fact, I think goes far to destroy the theory of the formation of these substances in the atmosphere.

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XXXI. *On the Geology and Mineralogy of the Island of  
New-York*, by DR. SAMUEL AKERLY.

DEAR SIR,

The following account of the Geology and Mineralogy of New-York was written in 1808, and constitutes part of an essay composed for a particular purpose, but as that purpose has not been answered, and this part comes within the view of your Journal, it is at your disposal for publication.

I am respectfully yours,

SAMUEL AKERLY.

Dr. Archibald Bruce.

*Geology of New-York.*

LITTLE can be said on the geology of so small a portion of country as the island of New-York. The relation it bears to the surrounding country in a geological view, would make it necessary to include in the same view a description of the country to a considerable extent. Its mineralogy, which is

the key to geology, or some inference drawn from mineralogical facts, may be described independent of the neighbouring country. Such facts must then remain, till sufficient are collected to form a theory. To take such an extensive range, would go beyond the task assigned in this undertaking.

Should I take up the subject of Geology, I would pursue it in the extent of its signification, commencing where Kirwan left off, and travel over the whole of North America. This celebrated author, when he had followed the great wave (in his account of the deluge) which arose from the southern abyss, and deluged the world, pursued its course and marked its operation, more particularly upon the eastern hemisphere, making but few observations on the western. The waters which rose between South America and Africa, were turned in their course from the latter, and scooped out the Carribbean sea and gulf of Mexico, being prevented from dividing the western hemisphere into two continents, by the mountains of Darien. This barrier again changed its course, and being joined by those which had risen from the Pacific Ocean, and overflowed the mountains, they took a north-easterly direction, and swept over the whole continent of North America. Hence the direction of the mountains in this part of the world. The shock and force of this overwhelming torrent becoming weakened in its course to the northward, had a less destructive effect on the mountains, and hence we find them higher in the northern latitudes of the United States,\* and the same inferences may probably be drawn, when we learn more of Louisiana. Thus would I proceed to trace the effects of the deluge upon our own continent, marking the indentations and bays along the

\* Mr. Jefferson conjectures the highest mountains in Virginia to be 4000 feet. (See notes on Virginia, p. 29.) But by measurement they are 2706, in Maryland 3257, in New-York 3549, in Vermont about the same height, and in New-Hampshire 7800. *Volney's view of the United States.*

coast, and the points of land directed to the south, inclosing them, made by the receding of the waters and subsequent alluvions.

But to return to the narrow limits of our small island. Its solid rocky base without a vestige of animal remains, in the form of petrifications, points to its primitive origin. The island is divided into its primary and secondary parts. The first is a solid mass of granite and limestone; and the second is composed of an alluvion of sand, stones, and rocks. The primary part is all the island, except that over which the city is built. It is therefore necessary to account for the formation of the south part of New-York county, and this will be subsequent to the Creation, and even the Deluge.

After the waters of the Deluge had retired from this continent, they left a vast chain of lakes, some of which are still confined within their rocky barriers. Others have since broken their bounds, and united with the ocean. The Highlands of New-York was the southern boundary of a huge collection of water, which was confined on the west by the Shawangunk and Kaats-kill mountains. The hills on the east of the Hudson confined it there. When the hills were cleft and the mountains torn asunder, the water found vent and overflowed the country to the south. It was then that the channel of the Hudson was formed, and its stream has never since ceased to flow. The earth, sand, stones and rocks brought down by this torrent, were deposited in various places: as on this island, Long Island, Staten Island, and the Jerseys. This opinion is mostly hypothetical, because unsupported by a sufficient number of facts, but that it is probable may be judged by what follows.

The north part of Long Island is indented by a number of bays made at that time, having no rocky basis to resist such an impression. In levelling the hills to extend the improvements of the city of New-York, accurate observation will show that some such catastrophe has taken place. When the various materials diffused in the water, and carried a-

long by the torrent, began to precipitate, each observed its particular disposition. The sand collected at the bottom, and through this the rocks scattered themselves promiscuously, and sunk according to their weight or the looseness of the sand. Hence the rocks are found in the hills without any order. This process may be compared to sifting, for the stones which were not heavy enough to sink in the sand, arranged themselves in a stratum near the surface. Above this is generally a stratum of clay, and then the productive soil. This is the disposition of hills that have been levelled in and about the city of New-York. The rocks found in them are granitical masses, with some magnesian. The stones are all rounded and water-worn; mostly granite, some magnesian, quartz, and slate. The latter must certainly have been brought from the slate country above the Highlands. These stones are in great numbers, and employed to pave the city.

Blackwell's island near Hurl-gate, is a mass of rock, similar to that part of York island opposite. A considerable part of the building stone used in the city, is brought from quarries in the granite of this island. The tide has gradually worn away the earth from the strata and beds of rock about Hurlgate, and formed that streight.

## 2. *Mineralogy of New-York.*

The county of New-York as was observed when treating of its geology, is divided into its primary and secondary parts. The body of granitical rock forming the base of the island, has a direction nearly S. W. and N. E. It appears to be veined in that direction, as may be seen where quarries have been opened to procure building stone. Where no disintegration has taken place from decomposition, the colour of the granite is blue. The various aggregates found among granite are seen in different places in this county, as granatines, granitelles, granilites, gneiss, &c.; also gar-

nets, various forms of magnesian earth, and plumbago, of which it is necessary to be more particular.

*Of Aggregates.*

1. Quartz, feldspar, and mica in various proportions form *Granite*.† When fresh from the quarries in and about the island of New-York it is blue, being darker or lighter, according to the prevalence of one or other of the constituent parts. On some points of land, and in some places along the shores, the granite has a vertical direction, inclining towards the east. It is frequently found traversed by veins of quartz in the same direction, and sometimes transversely.

2. *Granitines* are also ternary combinations, which are frequent and various in granitical tracts. Of these I have seen the following in and about New-York, viz.

Quartz	Quartz	Quartz	Quartz	Quartz
Feldspar	Feldspar	Mica	Mica	Shorl
Shorl	Garnets	Shorl	Garnet	Garnet.
Feldspar	Feldspar	Feldspar*	Feldspar†	Feldspar
Mica	Garnet	Quartz	Quartz	Quartz
Shorl	Shorl	Plumbago	Amianthus	Tourmaline.

3. The name of *Granitell* is given by Kirwan to binary aggregates, of which the following are frequent in this county, viz,

Feldspar	Feldspar	Feldspar	Quartz	Quartz
Shorl	Mica	Quartz	Shorl	Mica

\* This combination is from some part of Westchester county.

† This specimen I found on Long Island. The amianthus is intimately woven in the texture of the stone.

‡ Kirwan's mineralogy, vol. 1st, p. 338. London, 1794.

Shorl } Shorl } Quartz } Feldspar  
 Mica } Garnet } Jade\* } Plumbago.†

4. Aggregates of more than three constituent parts are called *Granilites*. The following are to be found in New-York.

Quartz } Quartz } Quartz } Quartz  
 Mica } Mica } Feldspar } Feldspar  
 Feldspar } Shorl } Shorl } Shorl  
 Garnet } Garnet } Garnet } Plumbago.

This latter specimen in my possession containing plumbago in specks, is mentioned in the *Medical Repository*, vol. 4, p. 419, as the ore of Molybdena, but I have since been informed that it has been found to be the carburet of iron or Plumbago.

5. *Gneiss* is another aggregate of quartz, feldspar and mica, in which the latter is in the least proportion. This is also frequent on York Island.

6. *Mica* is to be found in great plenty, and entire pieces as large as the palm of the hand may be broken or cut out of the rocks for the supply of cabinets, sometimes of the thickness of half an inch. Its colour is generally grey, silvery white, and blackish.

7. *Garnets* are found from the size of a pin's head to an inch in diameter, crystallized and dispersed through the granitical rocks. They are all crystallized in twelve sided figures, presenting equal rhomboidal planes. They are brittle and not worth cutting. Their colour is dark red. It is remarkable that mica is found in most of these as also shorl, these substances having interposed during the process of crystallization.

\* A specimen of this kind I found at Red Hook, Long Island, in the township of Brooklyn.

† I think I found this specimen on Long Island some years ago. The feldspar is in a partial state of decomposition.

*Of Magnesia.*

Rocks in which magnesian earth predominates, are frequently found in New-York County, though not in very large masses, but mostly in small detached pieces. Some of these are steatites, some serpentines, and others asbestos. Many elegant specimens of steatites may be procured, some of which have handsome dendritical appearances upon them. The serpentines are not very beautiful, but there are a great variety of the forms of asbestos, some of which nearly approach to amianthus. The stellated, the plumose, the fibrous asbestos are met with. This island and the neighbourhood affords a great opportunity to a mineralogist to make a large collection, particularly of the magnesian earths and granitic compounds.

*Of Limestone.*

The primitive limestone which is found on the north end of the island, is the commencement of a more extensive tract of the same, seen in the adjacent county of Westchester.

*Chalybeate Well.*

Dr. Mitchill has furnished the following memorandum of a chalybeate well in the suburbs of the city, which it is thought proper to annex to the mineralogy of this district of country.

“There are frequent instances of water holding iron in solution. Weak springs of this kind are not uncommon. The following is one of the most instructive cases of a chalybeate water at New-York. This is a well on the Incleberg, which has a strong impregnation of iron. It is on the land of Mr. Coster, and there is about twenty feet of water in the well. It was dug at great expense through the incumbent earth, and a subjacent stratum of granite rock. The peculiarity of the water in this well is, that the fluid

pumped from the bottom, had a plentiful chalybeate charge, while that dipped with a bucket from the top, gave no ferruginous indication whatever.

The nozzle of the pump, and the stones on which the water descended from it were marked by a deposition of yellowish ochre. Clothes washed with it were tinged of the same colour. The prussiate of potash instantly changed the pumped water to a bright and beautiful blue. The oxalic acid gave no indication of lime. Potash precipitated very little, but the metal held in solution. In other respects, the water appeared to contain few foreign ingredients incorporated with it. These facts were ascertained in September 1808.

XXXII. *Observations on the Saint Maurice iron-works, near the town Three Rivers, in the province of Lower Canada.*  
By WILLIAM SMITH, Esq. of Quebec.

**S**AINTE MAURICE lies about three leagues or nine miles from Three Rivers. The country is flat. The iron works were constructed during the time this Province was under the dominion of France, and they are now held by lease from the crown at the rent of £500 sterling per annum, by two merchants of the first respectability of Quebec; namely, Messrs. Monro and Bell. The situation for carrying on these works, is a very advantageous one, having a constant run of water, and the fall such as to require little or no banking or draining. The establishment forms a beautiful village, wholly inhabited by workmen and their families. The number of men and boys employed, exclusive of cutters and colliers, may exceed one hundred. There is a flour-mill and saw-mill on the premises, also a baker and butcher.

There is at present one furnace, two forges, with one

hammer each for bar iron, two carpenter's shops, two wheelwright's and three black-smith's shops. The bellows are of the horizontal or common kind. There is a great and increasing demand for the iron, and no doubt the lessees will find it for their interest to enlarge their establishment.

The ore is procured about two leagues from St. Maurice: its general depth from the surface of the earth, from three to ten inches, and is generally found in swampy grounds: the beds are very irregular, at times taking sudden turns under roots of large trees. The direction is from N. N. E. and S. S. W. like the primitive strata of New England. The inclination perpendicular. The beds have been traced some distance, and promise to afford an abundant supply.

The colour of the mineral is a bluish grey, similar to that of Sweden, and the same species that furnishes Europe and America with their best iron. In the neighbourhood is found a greyish granular limestone, and clay which serves the furnace for a flux. The height of the furnace is from the hearth to the crown, about twenty-five feet. The bar-iron is of an excellent quality, very malleable and tough. There is no steel furnace.

*Quebec, 10th March, 1812.*

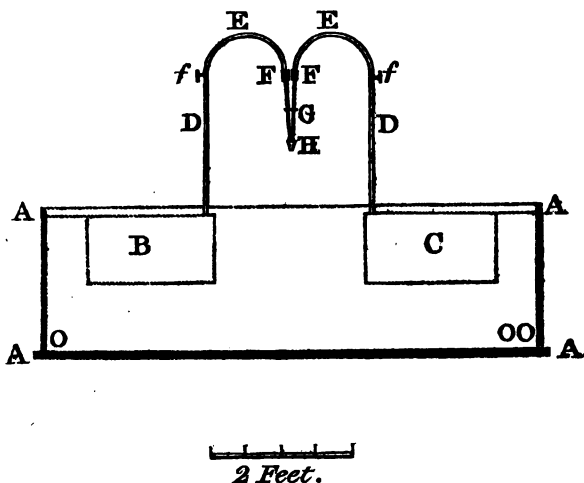
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**XXXIII.** *On the powers of the COMPOUND BLOWPIPE.* By BENJAMIN SILLIMAN, Esq. Professor of Chemistry in Yale College, New Haven.

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The following is a section of the Pneumatic Cistern of Yale  
VOL. I. 2 C

College, with the Compound Blow-pipe of MR. HARE, for burning hydrogen, mingled with oxygen gas.



REFERENCES TO THE FIGURE.

- AAAA. The pneumatic cistern, filled with water; (for a plate, and full description, see the Boston edition of Henry's Chemistry.)
- B. A gas reservoir, of the capacity of twelve gallons, filled with oxygen gas, either by the action of hydrostatic bellows at o, or by a received tube passing from above, through the water, and hooked under B; parallel to B, and contiguous, on the other side of the cistern, is another gas reservoir, of the same capacity, which may be connected with B, or not, at pleasure.
- c. The same in every respect, only c is filled with hydrogen by hydrostatic bellows at oo, or by a received tube as above.
- D. Copper tubes half an inch in diameter, furnished with stop cocks at f, and inserted into the gas reservoirs B. c.
- E. Recurved tubes of flexible metal, furnished with double screws at F, which connect them with a pair of brass blow-pipes, cut off at G and soldered to two strong cast silver

tubes, which screw *air-tight* into H, an inverted pyramidal piece of platinum, in which two converging ducts as large as a pin are perforated, forming a continuation of the tubes, and uniting in a common passage somewhat larger, just before their exit, at the common orifice below.

The subject to be operated on, is sustained by charcoal or forceps, and held by the hand, just below the orifice, in the piece H.

The gases at B, C, are under hydrostatic pressure, which is easily recruited, as the gases run out, either by throwing common air with the bellows, into one of the spare reservoirs, or by introducing more of either of the gases into the appropriate reservoir, and peculiarly of hydrogen, both on account of the facility with which it is obtained, and because twice as much of it in bulk is wanted, as of oxygen.

The rapidity of efflux of the gases, and their due proportion, is easily regulated by turning more or less, the keys of the stop cocks, at F, and the effects of either gas alone may be observed, by shutting the stop cock leading to the other.

When the compound flame is desired, the hydrogen is first let out and fired; the blaze should be somewhat larger than that of a candle; the oxygen is then let in to the hydrogen till the effect is the greatest, which a little habit will soon ascertain.

The flame of the hydrogen is very much narrowed, by the introduction of the oxygen, and there is no appearance of peculiar splendour or heat, till some body capable of accumulating and reflecting the light and heat, is placed in the focus, which is usually about  $\frac{1}{4}$  of an inch below the orifice.

All the apparatus below FF, is easily detached, by turning the double screws: the strong silver tubes are intended to prevent fusion of this part of the apparatus, and to admit of connexion with the platinum piece, by *means of a screw cut on the silver tubes*; this obviates the necessity of using a solder, which would be very liable to melt, and the plati-

num piece, is for a similar reason substituted for the silver cylinder originally used by Mr. Hare, as experience has shewn that these are liable to fusion.

No flux or addition of any kind was employed in the following experiments.

**EXPERIMENTS ON THE FUSION OF VARIOUS REFRACTORY BODIES, BY THE COMPOUND BLOW-PIPE OF MR. HARE.**

The philosophical world beheld with pleasure and astonishment, the effects produced on the fusion and combustion of bodies by a stream of oxygen gas, directed upon burning charcoal. The splendour of these experiments arrested universal attention, and Lavoisier, with his gazometer was enabled in this manner to produce a degree of heat, surpassing that of the most powerful furnaces, and even of the solar focus. Bodies which no degree of heat, previously applied, had been able to soften, now became fluid, and philosophy appeared to have attained the limit of its power in exciting heat; indeed, it seemed to have advanced very far towards realizing the opinion, that solidity and fluidity are accidental attributes of bodies, dependant solely on the quantity of caloric which they contain, and that therefore, they may be supposed capable of existing in either of these conditions.

Still however, there were, in fact, many important exceptions. Of the primitive earths, Lavoisier had been enabled to fuse only alumine.—While the rest remained refractory, and seemed fully entitled to the character of infusibility, usually attributed to this class of bodies, many native minerals, and especially those which are most distinguished for hardness, beauty, and simplicity of composition, maintained the same character, and some of them refused to melt, even when heated with powerful fluxes.

The beautiful invention of Mr. Robert Hare of Philadelphia, by which he succeeded in burning with safety and con-

venience, the united stream of oxygen and hydrogen gases, greatly extended our dominion over refractory bodies, and presented new and very interesting results. Mr. Hare's memoir, originally communicated to the Chemical Society of Philadelphia, has been some years before the public, and has been republished and handsomely noticed, both in France and England. Still however, his results have not found their way into the systematical books on chemistry, with the exception of Mr. Murray's system, notwithstanding that some of the European professors have availed themselves of Mr. Hare's invention, so far as to exhibit his most splendid and striking experiments to their classes.

The writer of this article, although fully disclaiming any share in Mr. Hare's invention, was early associated with him in his experiments; they excited in his mind a degree of interest, which led him to hope that they would be repeated and extended by others, but as nothing of this kind has appeared in this country, perhaps the following experiments may not be altogether uninteresting, especially as they were performed with an apparatus of a construction somewhat more simple than the original.

It will be necessary to recollect that Mr. Hare not only melted alumine, which Lavoisier had done before, but also *silex*, and *barytes*, and by subsequent experiments, he added *strontites* to the list of fusible bodies; he was inclined to believe that he had volatilized gold and silver, a conclusion which was rendered highly probable, by his having afterwards evidently volatilized platinum. Lime and magnesia were softened, but not completely fused.

The experiments of Mr. Hare, as will appear below, have been repeated by the writer of this paper with success, and many other bodies among the most refractory in nature, have been melted. For the sake of shewing how far the experiments now to be recited, have affected our knowledge of the dominion of heat, quotations for comparison will occasionally be made from one of the latest and most respect-

able chemical authorities. (Murray's System, 2d edit.)

BODIES SUBMITTED TO THE HEAT OF THE COMPOUND  
BLOW-PIPE OF MR. HARE.

*Primitive Earths.*

**SILEX**—being a fine powder, it was blown away by the current of gas ; but when moistened with water it became agglutinated by the heat, and was then perfectly fused into a colourless glass.

**ALUMINE**—perfectly fused, into a milk white enamel.

**BARYTES**—fused immediately, with intumescence, owing to water, as observed by Lavoisier ; it then became solid and dry, but soon melted again into a perfect globule, forming a greyish white enamel.

**STRONTITES**—the same.

**GLUCINE**—perfectly fused, into a white enamel.

**ZIRCON**—the same.

**LIME**—In small pieces it was immediately blown off from the charcoal ;—to prevent this, as well as to obviate the suspicion, that any foreign matter had contributed to its fusion, the following expedient was resorted to. A piece of lime, from the Carrara marble, was strongly ignited, in a covered platinum crucible ; one angle of it was then shaped into a small cylinder, about one fourth of an inch high, and somewhat thicker than a great pin ; the cylinder remained in connexion with the piece of lime ; this was held by a pair of forceps, and thus the small cylinder of lime was brought into contact with the heat, without danger of being blown away, and without a possibility of contamination ; there was this farther advantage, (as the experiment was delicate, and the determination of the result might be difficult) that, as the cylinder was held in a perpendicular position, if the lime did really melt, the column must sink, and become, at least to a degree, blended with the supporting mass of lime.

When the compound flame fell upon the lime, the splen-

dour of the light was perfectly insupportable, by the naked eye, and when viewed through deep coloured glasses, (as indeed all these experiments ought to be) the lime was seen to become rounded at the angles, and gradually to sink, till, in the course of a few seconds, only a small globular protuberance remained, and the supporting mass of lime was also superficially fused at the base of the column through a space of half an inch in diameter. The protuberance, as well as the contiguous portion of lime, was converted into a perfectly white and glistening enamel; a magnifying glass discovered a few minute pores, but not the slightest earthy appearance. This experiment was repeated several times, and with uniform success; may not lime therefore be added to the list of fusible bodies?

**MAGNESIA.** The same circumstances that rendered the operating upon lime difficult, existed, in a still greater degree, with respect to magnesia; its lightness and pulverulent form rendered it impossible to confine it for a moment upon the charcoal, and as it has very little cohesion, it could not be shaped by the knife as the lime had been. After being calcined, at full ignition, in a covered platinum crucible, it was kneaded with water, till it became of the consistence of dough.—It was then shaped into a rude cone, as acute as might be, but still very blunt; the cone was three fourths of an inch long, and was supported upon a coiled wire.—The magnesia, thus prepared, was exposed to the compound flame; the escape of the water caused the vertex of the cone to fly off, in repeated flakes, and the top of the frustrum that thus remained, gave nearly as powerful a reflection of light as the lime had done; from the bulk of the piece (it being now one fourth of an inch in diameter at the part where the flame was applied) no perceptible sinking could be expected. After a few seconds, the piece being examined, with a magnifying glass, no roughnesses or earthy particles could be perceived on the top, but a number of glossy smooth protuberances, whose surface was a perfectly white enamel; this

experiment was repeated with the same success. May not magnesia, then be also added to the table of fusible bodies ?

YTTRIA was the only remaining primitive earth, but no specimen of it could be obtained.

Perhaps then we shall be justified in saying, in future that the primitive earths are fusible bodies, although not fusible in furnaces, in the solar focus, nor (with the exception of alumine, and possibly barytes,) even by a stream of oxygen gas, directed upon burning charcoal.

PLATINUM was not only melted but volatilized with strong ebullition.

#### *Various Minerals.*

ROCK CRYSTAL, transparent and colourless.

This mineral was instantly melted into a beautiful white glass.

"It not only does not melt in the focus of the most powerful burning mirror, but it remains without fusion, at least when in the state of rock crystal, in the still more intense heat excited by a stream of oxygen gas directed on burning charcoal." *Murray*, II. 261.

"It is even imperfectly softened by the intense heat excited by a stream of oxygen gas, directed on the flame" (of the blow pipe lamp.) *Ibid.* III. 513.

COMMON QUARTZ, fused immediately into a vitreous globule.

GUN FLINT melted with equal rapidity: it first became white, and the fusion was attended with ebullition, and a separation of numerous small ignited globules which seemed to burn away as they rolled out of the current of the flame; the product of this fusion was a beautiful splendid enamel. "It is infusible before the blow-pipe, but loses its colour." *Murray* III, 518.

CHALCEDONY melted rapidly, and gave a beautiful bluish white enamel resembling opal. "It is infusible before the blow-pipe." *Ibid.* 516.

RED JASPER, from the Grampians, was slowly fused with a sluggish effervescence : it gave a greyish black slag with white spots. " It is infusible before the blow-pipe, even when the flame is excited by a stream of oxygen gas." *Ibid*, 519.

SMOKY QUARTZ, or smoky topaz, melted into a colourless globule.

BERYL melted instantly into a perfect globule, and continued in violent ebullition, as long as the flame was applied, and when after the globule became cold, it was heated again, the ebullition was equally renewed ; the globule was a glass of a beautiful bluish milky white.

" The beryl is melted with difficulty before the blow-pipe alone, but easily when borax is added." *Ibid*. 511.

EMERALD OF PERU the same, only the globule was green and perfectly transparent.

OLIVIN fused into a dark brown globule, almost black.

" It can scarcely be melted by the blow-pipe without addition." *Ibid*. 534.

VESUVIAN instantly melted into a beautiful green glass.

" It melts before the blow-pipe into a yellowish glass." *Ibid*. 534.

LEUCITE instantly fused into a perfectly transparent white glass ; the fusion was attended with strong ebullition and many ignited globules darted from it and burnt in the air, or rolled out upon the charcoal and then burned ! Were they not potassium ? This stone contains full 20 per cent. of potash : this hint will be resumed below.

" It is not fused before the blow-pipe." *Murray*, III. 534.

CHRYSOBERYL (Cymophane of Haüy) was immediately fused into a greyish white globule.

" It is not melted by the blow-pipe." *Ibid*. 439.

A CRYSTALLIZED MINERAL from Haddam, Connecticut, which according to the Abbe Haüy is *Cymophane* ; it fused

with ebullition, and scintillations, and produced a very dark globule almost black.

TOPAZ OF SAXONY melted with strong ebullition, and became a white enamel.

“It is infusible before the blow-pipe, but melts when borax is added.” *Ibid.* 498.

SAPPAR OR CYANITE, perfectly and instantly fused, with ebullition, into a white enamel.

“It remains perfectly unaltered before the flame of the blow-pipe, even when excited by oxygen gas.” *Ibid.* 499.

CORUNDUM of the East Indies was immediately and perfectly fused, into a grey globule.

CORUNDUM of China, the same with active ebullition.

“Corundum is not fused by the flame of the blow-pipe on charcoal, even when soda or borax is added to it.” *Ibid.* 495.

ZIRCON OF CEYLON melted with ebullition, into a white enamel.

“It is not melted alone before the flame of the blow-pipe, but if borax is added, it forms a transparent glass.” *Ibid.* 539.

HYACINTH of Expailly fused into a white enamel.

“It loses its colour before the flame of the blow-pipe, but is not fused; it melts with borax into a transparent glass.” *Murray, III.* 540.

CINNAMON STONE instantly fused into a black globule with violent ebullition.

SPINELLE RUBY fused immediately into an elliptical red globule.

“It does not melt before the blow-pipe, but is fused by the aid of borax.” *Ibid.* 497.

STEATITE melted with strong ebullition into a greyish slag.

“It does not melt before the blow-pipe, but becomes white and very hard.” *Ibid.* 482.

Porcelain, common pottery, fragments of Hessian crucibles, Wedgwood's ware, various natural clays, as pipe and porcelain clay, fire and common brick, and compound rocks, &c. were fused with equal ease.

During the action of the compound flame upon the alkaline earths, provided they were supported by charcoal, distinct globules often rolled and darted out from the ignited mass, and burnt, sometimes vividly, and with peculiarly coloured flames. From the nature of the experiments, it will not be easy to prove, that these globules were the bases of the earths, and yet, there is the strongest reason to believe it: circumstances could scarcely be devised more favourable to the simultaneous fusion and decomposition of these bodies; charcoal highly ignited for a support, and an atmosphere of hydrogen also in vivid and intense ignition: that the oxygen should be, under these circumstances detached, is not surprising; but the high degree of heat, and the presence of oxygen necessarily burn up the metalloids almost as soon as produced. If means could be devised to obviate this difficulty, the blow-pipe of Mr. Hare might become an important instrument of analytical research. We can scarcely fail to attribute some of the appearances during the fusion of the leucite to the decomposition of the potash it contains.

This impression was much strengthened, by exposing potash and soda to the compound flame, with a support of charcoal; they were evidently decomposed; numerous distinct globules rolled out from them, and burnt with the peculiar vivid white light, and flash, which these metalloids exhibit, when produced and ignited in the galvanic circuit.

It is hoped that these hints may induce a farther investigation of this subject.

The experiments which have now been related, in connection with the original ones of Mr. Hare, sufficiently show that science is not a little indebted to that gentleman for his ingenious and beautiful invention. It was certainly a happy thought, and the result of very philosophical views of com-

bustion, to suppose that a highly combustible *gaseous* body, by intimate mixture with oxygen gas, must, when kindled, produce intense heat ; and it is, no doubt to this capability of perfectly intimate mixture between these two bodies, that the effects of the compound blow-pipe are, in a great measure, to be ascribed.

This communication has already been extended farther than was contemplated, but, in concluding it, it may be allowable to remark, that there is now, in all probability no body, except some of the combustible ones, which is exempt from the law of fusion by heat. If the primitive earths, and such minerals, as several of those which have been mentioned above, are fusible, no doubt can be entertained that all other mixtures and combinations of earths are fusible also ; for, such mixtures and combinations are known to be more fusible than the primitive earths ; the metals are more fusible than the earths, and the diamond along with carbon in its other purest forms, appears to be really the only exception ; and it is probable that this is only a *seeming one* ; for, it is scarcely possible to expose these bodies to the heat of the compound blow-pipe without at the same time burning them up ; could the heat be applied without exposing them to the contact of oxygen, is it not probable that they also would be added to the list of fusible bodies ?

Yale College, May 7th 1812.

*Communicated to the Connecticut Academy of Arts and Sciences, and with their permission to the Mineralogical Journal of Dr. Bruce.*

XXXIV. *A Sketch of the Scenery in the region around Harper's ferry, where the ridge of Blue Mountains is penetrated by the joint waters of the Potomac and Shenandoah rivers. In a letter from the Hon. SAMUEL L. MITCHELL, to the EDITOR; dated Harper's ferry, July 4th 1812.*

**B**EING on a visit to the arsenal and manufactory of arms belonging to the United States at Harper's ferry, and having received from Mr. Annin and Mr. Stubblefield all the attentions which their own politeness, and a letter from the secretary at war, could procure for me, I avail myself of the opportunity which my situation affords, to examine the appearances of the neighbouring region. It is now the anniversary of our national independence; and I have surveyed the shops where eight hundred and fifty muskets and bayonets complete, are fabricated monthly out of the crude materials, amounting to more than ten thousand stands per annum, as good as ever were put into the hands of a soldier; besides a considerable number of rifles and pistols. A few days ago many boxes filled with these-home made arms were sent down the river in boats to the city of Washington, for the use of the soldiers and citizens in the eastern section of the Union; and likewise a long train of waggons has proceeded to Pittsburgh, loaded with fire-locks for the equipment of our brethren in the western states.

The following is the history of this establishment, if I am not mistaken in my recollection.

The Congress organized under the present Constitution, having assembled at New-York on the 4th of March, 1789, did during its first session, to wit, on the 7th of August, establish an executive department for conducting its military affairs. The person at the head of this office, called the department of war, was authorised to receive and keep, all records, books, and papers belonging to the war department as

it had been arranged under the former confederation.

Afterwards, that is, in May 1790, the first act was passed for regulating the military establishment. The appropriations for the war department were comprehended in the general act for the support of government until March 1794, when for the first time, a distinct statute was enacted for military purposes only.

After various legislative expedients, session after session, the military establishment of the United States was adjusted and fixed by the law of May 30th 1796 (7 Washington,) and the several former acts repealed.

Again, on the 2nd of April 1794, it was enacted that arsenals and magazines should be repaired and established, to the number of three or four, at such places as in the judgment of the President would best accommodate the different parts of the United States. A national armoury was fixed at each of the said arsenals. And a superintendant and master-armourer were directed for each with regular pay. (5 Washington.)

When, on the 4th of May, 1798 (2 Adams) Congress empowered the President to purchase suitable places for the manufacture of cannon and small arms, to establish manufactories of the same, to employ artisans and labourers, and to appoint superintendants under the direction of the war department.

On the 28th of the same month, and within the same year, the President was authorised to raise a provisional army of ten thousand men. (2 Adams.)

On the 7th of May 1800, (4 Adams) it was provided that the superintendants and master-armourers, should have rations, or the value in money. Persons enticing artificers or workmen away from the arsenals and armouries of the United States, may on conviction be fined in a sum not exceeding fifty dollars, and be imprisoned for a time not exceeding three months. Artificers and workmen forfeit twenty dollars for wantonly destroying tools and implements,

or for violating their contracts, to perform services. Moreover, they are exempted from doing duty, in the militia, and on juries.

From that time to the present, there have been annual appropriations made by Congress for the due and steady support of arsenals, magazines and armouries. The sums have been liberal; and out of these, the works have been regularly kept a going.

Much might be written on this discussion of the Blue Ridge, or South Mountain, as it has sometimes been called. The great agent was probably the united current of the Potomac and Shenandoah. The mountains have every appearance of having formerly opposed a formidable barrier to the accumulated water. Obstructed, as it were by a dam, a pond or lake must have been formed beyond them. Their height is estimated at about twelve hundred feet, or not quite so much. Mr. Volney has incorrectly traced them along to the Kaatskill mountains of New-York; whereas they really belong to the Shawangunk Chain which is quite distinct, both as to its situation and composition; from the Kaatskill: the former being composed of quartz rocks and amygdaloid, and the latter of sand-stone.

The sides and summits of the mountains near Harper's ferry are now clothed with green oaks. Chesnuts, maples, and planes are frequent before the eye. The lime-tree, the tulip-tree, the locust-tree, and the willow-tree, overspread the surface with their verdure. While the persimmon, the papeflora, the calycanthus, and the papaw, strike their roots through the sands of the shores, and the crevices of the rocks.

The predominating rocks and stones dispersed over the parts of Virginia and Maryland, which lie on both sides of the Potomac between the tide waters at George Town and the Blue Ridge at Harper's ferry, are quartz. Masses of this silicious material possessing different shades of whiteness, are very frequent along the road, as you pass through.

Loudon county on the south, and through Montgomery and Frederic on the north side of the river.

Yet, it must be observed that the mixtures of quartz are various in this region. Where the Potomac penetrates the strata of rocks at the Little Falls above George Town, they assume the forms of granite, granitine, and micaceous shist. In some instances, quartz and schoerl are associated. In others mica and garnet are blended. Frequently quartz is found by itself; and then again mica is aggregated into enormous masses, forming the high banks and much of the bed of the river. Several other mixtures of these materials are found hereabout. The micaceous shist containing small garnets may be seen advantageously at the Chain-Bridge, three miles above Georgetown. The operations necessary for making a passage over the Potomac, have exposed the strata in a manner that favours examination.

The great falls of this river ten miles higher up the country are formed chiefly of micaceous shistus. The quantities are exceedingly great, and compose the high perpendicular and overhanging sides of the stream, as well as its bed, and the rocky islands between its two banks. The inferior locks of the canal made here by the Potomac Company for facilitating intercourse, are dug through strata of micaceous shist.

But the opening through the Blue Ridge at Harper's ferry is of a still different character. The gap reaches from its summit to its base, and discloses to the observer, its internal constitution. It is in such places, that the peculiar composition of the strata can be examined to more advantage than under most other circumstances. The rocks may be referred by the modern geologist to the TRANSITION order. And here Mr. Maclure has properly placed them, in his highly instructive chart of the United States. At the gap there is scarcely any mica to be seen. But the quartz is abundant. The structure of the mountain may be comprehended under the following mineralogical disposition. First, quartzy rocks

by themselves, with very little admixture. Sometimes large and milk-white or snow-white masses, make their appearance in other strata. Secondly, quartz blended with schist or slate. Both the materials are distinct, and they make coarse associations. The quartz is compact, granular, white, semi-transparent, cellular, ragged, and of various other qualities; but not often crystallized. The slate is of different hues, from pale to brown, greenish and black. Thirdly, quartz and hornblende. The material which I take to be hornblende, is of a brownish and frequently of a somewhat greenish hue, and mingled intimately throughout with the quartz. This composition appears to me to resemble, more nearly than any thing I recollect, the rocks at the upper falls of the Mohawk River. The hornblende is not known to be distinct, fibrous or crystalline. Fourthly, quartz and iron. Very commonly the quartz is coloured by a ferruginous tinge, and assumes therefrom a brown, reddish or rusty colour, and imparts the same to the other ingredients. Fifthly, quartz and feldspath; though this mixture occurred so rarely, that it is but barely worth the mentioning. Sixthly, quartz filling the veins and seams of all the other rocks, and giving them stripes or bands of clear white, and sometimes marking them with fantastic flourishes.

Such are the principal materials and their combinations at the Blue Ridge, where the waters penetrate it, on the territorial line of Maryland and Virginia. But the moment you leave the mountains skirting the Potomac and the Shenandoah on their eastern or atlantic side, the minerals are of a different character. Immediately at their bases, and at the banks of these respective rivers, the strata become schistose. The streams pass by islands, and roll over beds of slate. The strata lie, where they have not been deranged, at angles of from thirty-three to forty-five degrees from the horizon; and their dip or inclination, particularly in the channel of the Potomac is from N. W. to S. E. Suddenly

as you pass to the Virginia side, the slate rises with a rough, craggy, and picturesque front.

Between the margin of the water, and the foot of this elevation, stand the shops where the musquets, pistols, and rifles are manufactured for the United States. At this commodious spot, the water for turning the wheels and giving force to the machinery is conducted through a canal or race-way about a mile in length. In several places, this passage has been dug through layers of slaty rock. A principal part of the stone-work consists of the same material; for although it does not split into forms fit for covering houses, it may be separated into slabs and flags fit for walls and floors. Here it is rare to behold any mixtures of quartz; yet small parcels may be found. No other mineral abounds. Slate prevails every where. The heights from which the traveller surveys the sublime and picturesque scenery hereabout, are slate. In short, whether wells are opened for water, foundations for buildings, or graves for the dead, parcels of schistus are raised with the spade. And from the lowly channel to the pinnacle where the powder magazine stands, the solid body of the mountain is brittle schist. In some places the layers appear to have been disturbed; for some of them are cracked through perpendicularly: some approach a horizontal direction; and others are jumbled into confused heaps. The removal of sand, gravel, and under propping by rains, has in some instances left the rocks in odd-shaped piles; and as these shall be further deprived of support, they will quit their present abodes, and rush precipitous to the vallies. The road travelled by Braddock towards the fatal plains of Monongahela in 1755, and the ground occupied by the provisional army under Pinkney in 1800, are underlaid by foundations of slate.

Yet, in less than two miles, as you proceed up the Potomac, lime-stone makes its appearance; and you meet with the like in travelling a few miles up the Shenandoah. I am

informed that schistus and quartz were heaped high in alternate and distinct strata, about ten miles hence, on the banks of this latter river.

Indeed it seems to me, as evident as the nature of the case admits, that in Virginia as in New-York, slate underlays and supports the lime-stone. And it may be conceived as in the highest degree probable, that the same material which reaches to the foot of the Blue Mountains, on the Virginia side of the Potomac, and on the Winchester side of the Shenandoah, is continued beneath their elevated ridges, and bears them on its back, as it does the Kaatskill and the Newburg mountains in New-York. Let the geologists in these parts of America particularly, study the history of slate.

The Scenery about Harper's ferry is much and justly celebrated. Several artists have attempted to paint it. I recollect to have seen several years ago, a picture of it, by some person whose name I do not now remember, in the Washington house at Mount Vernon. My attention was called to a striking view of it, at the principal inn near Elliott's mills, on the Petapsco in Maryland; and I examined an excellent sketch of the same, in the possession of a gentleman at Baltimore. Your best point for observation is a romantic pile of schistic rocks, situated between the summit and the Shenandoah. The prospect is eastward or down the stream. The two rivers unite at a point just beneath you, and pursue a roaring and foaming course through the dreadful breach they have made. The landscape consists of water finding its way toward the ocean amidst ledges and projections of rocks; of vegetables endeavouring to cover with their verdure the sandy beach, and the ruinous terminations of the strata; and of the ferries, roads, and buildings superadded by the industry of man. The whole is terminated by a distant perspective through the gap as far as the eye can distinguish, of woods, hills, farms, and other ru-

ral objects. The whole forms a rare and admirable display of the productions of art and of nature.

Nevertheless, I feel as if I ought to lay down my pen, even after the animation and delight, which the surrounding objects have excited, for the exertion of the limbs necessary to afford full gratification to the eyes, is quite as much as can be made, without bordering upon fatigue.

*Harper's ferry, July 4th 1812.*

XXXV. *Observations on the Mass of Iron from LOUISIANA, by COLONEL GIBBS. Communicated in a Letter to the EDITOR.*

Dear Sir,

I HAVE examined the mass of malleable iron, described in the second number of the Journal, which description I find perfectly correct; except that it appears to me less oxydable than our common purified iron. I was some time undecided in my opinion upon the origin of it;—whether it should be considered as a production of art or nature. I had never seen any mass of native iron which was compact; but the immense weight of this body, seemed to render its artificial production an improbability. I therefore concluded to search for *Nickel* in it; the presence of which, I considered would establish it as a natural production. It being very well known that this last metal is found united to native iron, both in the meteoric stones, and in the large masses of which the origin has not yet been determined. By this union, probably the iron is rendered more malleable and less oxydable, and the extreme tenacity of this as well as other masses, is very remarkable. Professor Silliman was so obliging as to make the experiment with me, which gave us a small quantity of nickel, and has therefore, I think, completely proved this mass to be a production of nature. During the

dissolution of this iron in diluted muriatic acid, I observed that there was suspended in the liquid a very small portion of black insoluble substance, which afterwards disappeared, and I suspected to be either carbon, or a carburet of iron. Which conclusion appears warranted by the unequal hardness of the mass, some parts being easily cut by the chisel, and others speedily destroying the best tempered instrument.

The discovery of the origin of this mass led me to procure some further specimens for examination; and the proprietor, Mr. G. Johnson of this city, was so obliging as to gratify my wishes. I was enabled therefore to procure after much labour, three or four small specimens. You will easily conceive my surprise in finding two of these pieces crystallized in the interior in octaedrons, like the magnetic iron ore. (*fer oxydulé* of Haüy.) They have the same characters as the rest of the mass in which they are imbedded, being only semi-hard, and easily cut with a knife, and some interstices appear between the lamina which mark the *decroissemens*, as is often observed in the crystals of the magnetic ore. The largest crystal was more than half an inch long.

The sight of this interesting specimen recalled to mind a mass of malleable iron which I met with in a mineralogical excursion in the Ardennes in France, in 1805. It was at that time lying in the road at Bithbourg department *des Forêts*, and was supposed to weigh about 2500 pounds. The peasants informed me that it was formerly on the top of a neighbouring hill, and had been rolled down by them. The difficulty of cutting it up for the furnace had been its protection, and probably it still continues there. Having fortunately preserved a specimen of it, I determined to subject a part to the same analysis, which afforded also nickel, and authorises me to consider it also as native iron. The mass was of a globular form, probably from the edges being cut off by the peasants: some parts of it semi-hard, others

striking fire with steel. It was perfectly compact. Its other characters like that of Louisiana.

It is proper to remark that the masses of native iron found in Siberia, differ in some respects from those which are the subject of this letter.

1st. The mass of native iron from Siberia described by Pallas, which weighed 1800 pound, is cellular, and the cavities filled with a yellow vitreous substance resembling the crysolite.

2d. Those of Durazzo, weight 40,000 lb. ; of Zacapetas, 1200 lb. ; and of Peru, which Humboldt describes as resembling the former.

3d. That of South America described by Don Rubin de Celis, weight 30,000 lb. ; the exterior of which is compact, the interior cellular, but not containing any vitreous substance. Proust in his analysis of this mass, mentions that he found a trace of carburet of iron, besides nickel, the same as I noticed with respect to that of Louisiana.

4th. A mass, weight 16,000 lb., found near Magdeburg, which is said by Chladni to have had the qualities of steel.

5th. A mass found in Senegal, of which we know only that it is of an immense weight, and by analysis yields nickel.

6th. Those found in Hungary, Bohemia, and Thuringia, of meteoric origin, of which the external characters are reported to be like that of Siberia. There are also accounts of native iron found with other iron ores in Germany and France ; but these do not contain nickel, and I believe are not much relied on. Native steel has been found in Auvergne, in small globules in a volcanic obsidian.

The two masses which are the subject of this letter, resemble these generally in colour, in being less oxydable than refined iron, in containing nickel, in tenacity, and in being found in insulated masses. That of Louisiana has a trace of carbon, and from the hardness of part of that of Bith-bourg, I should conjecture it also to contain some, like that of South America and Magdeburg. Those of Mexico and

Peru are found in volcanic countries as well as that of Bithourg, which is in the region of the extinct volcanoes of the Rhine. The most striking dissimilarity is, that those of France and Louisiana are compact, without any appearances of a vitreous substance or a cellular structure : but like that of South America, they may perhaps contain cavities in the interior, and (probably by attrition,) be compact on the surface.—The crystallization of the iron in one of these masses in octaedrons is worthy of notice. It appears that iron, whether slightly alloyed by nickel, oxyd of iron, or oxyd of chrome, preserves the same crystalline form.

As crystallized substances have been found in meteoric bodies,\* this discovery will scarcely affect any theory of the formation of these singular masses. On the one hand we have the established fact of the fall of the three bodies in Bohemia, Hungary, and Thuringia ; and on the other, that the locality of several of these masses is a volcanic region. I should therefore be inclined to adopt the theory of celestial origin for some of these masses, and that of the volcanic for others. But having met with but imperfect accounts of the other masses of native iron, and having only seen those of Thuringia and Siberia, I leave the discussion of this subject to abler pens and more willing minds.

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XXXVI. *A Descriptive catalogue of Minerals occurring in the vicinity of Baltimore, arranged according to the Distribution Methodique of Haüy, by ROBERT GILMOR, Jun. Esq.*

To the Editor of the American Mineralogical Journal.

Sir,

I BEG leave to return you my contribution of acknowledgment for the pleasure and information I have derived from

\* See No. 3, of the Am. Min. Journal. I have since found three other crystals of pyrites also in the Connecticut meteoric stone.

your valuable Journal, and I trust that every year will evince its utility, by the dissemination throughout the country, of mineralogical knowledge; and by exciting a spirit of inquiry and research among those whose leisure and opportunities may enable them to bestow some attention upon the mineral treasures of this hitherto unexplored field.

It has often occurred to me that it would facilitate and advance the object of your Journal, if the different gentlemen who are attached to the study of mineralogy, would carefully examine and furnish a list or description of the mineral substances in their immediate neighbourhood, stating the locality of each as nearly as possible, with such occasional remarks as might be deemed proper: a collection of such information would prove an useful manual for a mineralogical or geological traveller, and would, if the plan was generally adopted, soon furnish a mass of interesting knowledge respecting every district of our country. The advantages to the community at large from this knowledge being so extensively derived, are sufficiently obvious; and every lover of mineralogy would be able at once to discover the mineral he may be in pursuit of, or may wish to examine, or the spot with a view to its situation and accompanying substances. I confess I have often wished for such information while passing through districts which promised to reward me, if time would have afforded me the full and complete examination of them; and more than once has it happened to me to learn afterwards that had I been aware of the circumstance, my search would have been repaid by interesting discoveries.

Under this impression, and as a faint and imperfect specimen of the manner in which such a list or description might be drawn up, I beg leave to offer you the following sketch of the mineral substances to be found in the neighbourhood of Baltimore; chiefly limited to the range of twelve miles, except in a few instances where the mineral was too interesting to pass unnoticed. The arrangement is after the manner and nomenclature of Hatty, occasionally bearing also that of

Werner ; and as it is a first attempt of one whose limited knowledge of the subject should rather have forbid his exposing it in print, was it not for his desire to gain the same information from others, which he endeavours in this way to impart, he hopes that if the motives should be found sufficiently worthy to authorise your giving it a place in the Journal, you will have the goodness to excuse the imperfections with which he is too sensible the plan is executed.



#### EARTHY SUBSTANCES.

##### LIME.

*Carbonate of Lime* is found about 9 miles north west and north of the city, crossing the Falls turnpike and the York turnpike. It is principally pure white, and is crystallized, lenticular, laminated, fibrous, saccharoidal, compact, and pulverulent. The saccharoidal and compact furnishes the lime used in building, as well as slabs and steps for houses.—The kind called by the lime-burners alum limestone, is a pure white, semi-transparent marble, and of a very large grain.

*Phosphate of Lime, or Apatite* is found disseminated in grains and hexahedral prisms in a granite, the felspar of which is white, on the Falls turnpike, about two or three miles from town. It was at first mistaken for the emerald, from its being found in the same manner as the beryl of Philadelphia, and New-York. The colour varies from a bluish green to a bright lemon yellow.

*Sulphate of Lime.*—In Mr. Caton's lime-quarry, about 9 miles from town on the Falls turnpike, compact gypsum has been found in a small vein; and in the iron-mine bank near Hammond's ferry, a distinct crystal of selenite, which however may have been accidentally produced by the decomposition of pyrites in a calcareous soil.

#### STRONTIAN.

*Sulphate of Strontian* is believed to be discovered in a vein in one of the stone quarries on the Falls turnpike, on the east side of the Falls, about  $1\frac{1}{2}$  miles from town. It is however questionable.

#### MAGNESIA.

*Native Magnesia* is supposed to be found at the Barehills, about 7 miles from town in a serpentine rock.—It is in small flat prisms, accumulating to a dihedral summit. These crystals are found insulated, of a pure white and transparent; they are also found radiated from a common centre in every direction, and incrustated with a yellowish talcose substance. They calcine before the blowpipe into a white light powder, and effervesce briskly with nitric acid—*quere*.—Is it not a carbonate of lime combined with magnesia?

#### QUARTZ.

*Hyaline* or vitreous quartz found in every direction, viz.

*Crystallized* in white and brown crystals of all sizes.—

I have a fragment of one from the Mill-race at Ellicott's Mills, weighing nine pounds ; it is 5 inches in diameter, and presents the upper part of a prism regularly terminated in an hexahedral point.

*Rounded* pebbles.—The hills on which the city is built, present immense quantities in beds of various thickness.

*Concretionated*, in a ferruginous quartz on the Liberty Tour road, 4 miles. The concretions are milk-white, and covered with minute crystals. It is usually called *Calcedony*.

*Radiated*.—I do not find mention made by any writer, of *radiated* quartz. Yet such is certainly to be found on the Falls turnpike about 8 miles from town, where it occurs in large masses scattered over the hills. It is distinctly radiated, and the summits of the crystals which are compressed by each other to a point at the centre, are terminated at the surface in regular hexahedral pyramids.

*Quartz—Agate—Amorphous* ; on the Fredericktown turnpike, between the 6th and 7th mile stone.

*Quartz—Resinite* ; Pechstein of Werner.—At the Barehills, 7 miles on the Falls turnpike. It occurs in thin veins in a serpentine rock ; it is of a yellowish brown, and carious on the surface ; when fresh broken it is of a dirty white, and resembles calcedony so much as to have been often mistaken for it : on exposure to the air for any time it becomes smoky brown.

*Quartz—Jasper.*—A very beautiful specimen was found on the Fredericktown turnpike, 7 miles.

#### GARNET.

*Primitive, trapezoidal, and prismatic* garnets abound in the neighbourhood ; on the Falls turnpike they occur pretty large in a micaceous schistus.

#### FELSPAR.

*Compact Felspar*, compose great part of the gneiss and granite of the neighbourhood,—white, red, and green.

*Pearly Felspar*, or *adularia*, of a pure white, reflecting a light blue, is found in a granite vein in the quarries west of Jones's Falls, half a mile above the first turnpike gate.

*Aventurine Felspar.*—A small fragment was found at the Barehills.

*Decomposed Felspar* is found in considerable quantities, particularly on the Falls turnpike road, and would no doubt furnish an excellent material for the manufacture of porcelain.

*Crystallized Felspar* occurs in veins in the quarries on Jones's Falls accompanied by chlorite, epidote and axinite, (as it is believed) precisely resembling the same substances, and combined in the same manner as the specimens from the St. Gothard.

#### CORUNDUM.

An hexahedral crystal, *an inch in diameter*, was found at the Barehills, which in all its external cha-

racters corresponds with corundum, as described by Haüy ; but the writer considers it as doubtful.

#### TOURMALINE.

*Black Tourmalines* of all sizes are found in the immediate neighbourhood of the town, insulated and grouped. At the quarries on Jones's Falls, they are found in a granitic vein, upwards of three inches in circumference and several inches long.

#### AMPHIBOLE.

Or *Hornblende*, both *laminated and acicular*, is found near the city, and composes a great part of the rocks which form the bed of Jones's Falls. The *compact* forms a species of trap on the Frederick turnpike, about 5 miles from town.

#### STAUROTIDE.

In a micaceous schistus on the Falls turnpike,  $7\frac{1}{2}$  miles from Baltimore. The staurotide is found in small crystals, crystallized in hexahedral prisms with dihedral summits, resembling so much the pyroxene as one time to be mistaken for it. The schistus being in a state of decomposition, renders the staurotide when first obtained very tender and liable to be broken ; so that no complete cross formed by the junction of two prisms has yet been discovered, but fragments of such junctions are frequent. It is occasionally accompanied by the *Disthene Perihexaedre*.

## EPIDOTE.

Very beautiful crystals of epidote are found at the quarries on Jones's Falls, and in a quarry near the Frederick turnpike, about  $2\frac{1}{2}$  miles from the city. They traverse a vein of crystallized felspar and chlorite.

## MESOTYPE.

Very recently small yellow crystals of a pearly lustre, in quadrangular prisms, terminated by a lateral pyramid, which in their form precisely resemble the *mesotype pyramidale* of Hütty, have been found in a vein in the gneiss quarries, on Jones's Falls, accompanying chlorite, felspar, and epidote, and particularly very small crystals of a mineral not yet ascertained, but which appears to be metallic.

*Radiated zeolite* was found about 3 miles from the city, South of the Frederick turnpike.

## MICA.

*Crystallized and foliated*, is found in almost every direction.

## DISTHENE.

Or *Cyanite*, (lamellar,) of a pale green (rarely blue) is found in a micaceous rock, about 20 miles from town, on the Falls turnpike, at Scott's Mill, 7 miles from the York turnpike.—The crystals are large and small, many of them 4 and 5 inches in length; the loose masses in which it is also found, are of all sizes, and sometimes presenting little else but crystals of disthene

shooting in every direction, connected together by granular quartz.—It is also accompanied by garnets, and a heavy magnetic iron ore, which changes the disthene to a dirty brown. Perihexahedral and prismatic six-sided crystals are found on the Falls turnpike,  $7\frac{1}{2}$  miles from town.

#### GRAMMATITE.

Or *Tremolite*, is found among the limestone 11 miles from town, crystallized and compact; particularly at Nesbit's Marble quarry, York turnpike, &c.

#### ASBESTUS.

*Flexible, hard and ligniform* as well as *radiated* asbestos is found at the Barehills.

#### TALC.

*Talc Steatite* or *Specstein*,—waxy, at the Barehills.

*Pierre Ollaire* or *Potstone*,—at the same place.

*Talc Chlorite*,—at the quarries, and at the Barehills.

*Crystallized Talc*,—at the Barehills.



#### COMBUSTIBLE SUBSTANCES, NOT METALLIC.

*Bituminous Wood* has been found in several places, particularly near General Ridgeley's Furnace, 10 miles from town; and also at the edge of the city, where the red clay-bank of the harbour joins Fell's Point, near the Ship Yards.

*Bovey Coal* is found disseminated in the clay of Caton's ore-bank, near the Washington road, 3 miles from town.

*Coal* is also said to be found in immense beds near the Bodkin Point, at the mouth of the Petapsco, 15 miles from town; and the proprietor of the land is now sinking a shaft with a view to working the mine, if it shall prove to be of the right kind.

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#### METALLIC SUBSTANCES.

##### LEAD.

*Galena* has been found in a small vein in the quarries about the first Falls Turnpike gate, on the west side of Jones's Falls, accompanied by *black lead ore*, and blende or sulphuret of zinc. It is also asserted to be lately found in a large vein within 7 miles of the city, but the direction is kept a secret. The specimen seen by the writer, and said to come from the spot, was a large mass of galena.

##### COPPER.

*Grey Copper*, stated to be found near the city, and a good specimen of it is in the writer's possession; but the place is concealed.

*Green Carbonate of Copper*, and pyrites, the writer himself found on the Frederick turnpike when it was making, but could not ascertain whence it came.

*Black Oxyde of Copper* has also been found on the Frederick road.

# IRON.

*Magnetic iron ore* is found near Scott's mill, 20 miles on the Falls turnpike, and also about  $9\frac{1}{2}$  miles on the same road.

*Specular Iron*, occurs in the quarries near the town.

*Sulphuret of Iron*, (or common martial pyrites) abounds in all the quarries, and about 15 miles on Elkridge are found cubical pyrites an inch and more in diameter. At the Bodkin point, pyrites, common and *fossil* are to be found in very large quantities, and will probably become at some future day an object of importance.

*Hematites* occur on the York turnpike 9 miles, and on the road to Scott's mill.

*Argillaceous Iron stone* forms extensive beds to the south, southwest and west of the city about 3 miles. It is generally nodular, in concentric layers, between two of which it occurs crystallized in minute crystals of a blackish brown, known by the name of *velvet ore*. The furnaces in the vicinity are supplied chiefly from these beds; and from the ore bank on the York turnpike, 9 miles, some of the cannon of the United States has been made.

*Chromate of iron* is found in large quantities at the Barehills, 7 miles on the Falls turnpike, massive and granular, in veins and masses disseminated through a serpentine rock. Perhaps in no part of the world has so much been discovered at one place: it furnishes the means of preparing the beautiful paint called the chromic yellow, with which

carriages and furniture are now painted in Baltimore.

*Chromate of Iron* in octaedral *crystals*, very small, and magnetic, is found at the same place, and has no where else been discovered, as far as we can learn from the writings of mineralogists. The crystals mixed are found in the ravines, and on the sand of the rivulets of the Barehills, mingled with granular chromate of iron.

### ZINC.

*Sulphuret of Zinc or Blende* is found in small quantities in a thin vein of lead ore at the quarries, half a mile above the first gate of the Falls turnpike, on the west side of the Falls.

### MANGANESE.

*The black oxyde* is found disseminated among the rocks of the neighbourhood.

### MOLYBDENUM.

*Sulphuret of Molybdenum* is found at the quarries on the Falls turnpike.

### TITANIUM.

*Red oxyde of Titanium*, crystallized, has been found to the westward about 12 miles. The writer picked up a small piece on the Frederick turnpike (when it was making) within a mile of the city.

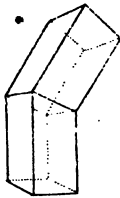
*Siliceo-calcareous Titanium* is disseminated throughout the granite at the Falls of Petapsco, about 10 miles on the Frederick turnpike, (of which the cathedral is built,) and also at the



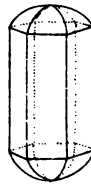
ORES OF TITANIUM.

OXIDE.

*Fig. 1.*



*Fig. 2.*

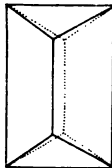


SILICO CALCAREOUS OXIDE.

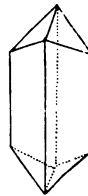
*Fig. 3.*



*Fig. 4.*



*Fig. 5.*



*A. Anderson: sc.*

*Engraved for the American Mineralogical Journal.*

Barehills, in a yellowish felspar *aventuriné*. The crystal is Hatly's *Dittträedre*.

#### CHROME

Is already mentioned among the iron ores. The *green oxide*, is also found at the Barehills, colouring the talc, as well as the *ruby or violet coloured ore*.

The aggregates, including the clays, which form a very large portion of the alluvial soil of the neighbourhood, shall be communicated in a future list, when they shall have been carefully examined.

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#### XXXVII. *Description of some of the combinations of TITANIUM occurring within the UNITED STATES—by the EDITOR.*

OF the many new discoveries which have enriched the science of Mineralogy, none have proved more interesting and worthy of notice, than those which relate to the metals; the number of which has been increased within a few years to an extent not to have been expected, when we consider the few which fell within the observation of the ancient mineralogists. For these we are, in great measure, indebted to the improvements which have taken place in analytical chemistry. To Scheele, and several of the late chemists, and particularly those of the present day, we owe much for our knowledge of the new metals, most of which have been recognized within the United States: and several which are of rare occurrence in the eastern, are found in abundance in the western hemisphere. Among these is *Titanium*; some of the ores of which, that occur in the United States, it is the object of the present paper to describe.

The first discovery of Titanium, is due to an English

mineralogist, the Rev. William Gregor, F. R. S. who is analysing a ferruginous sand from Menachan, in Cornwall, detected a metal differing in properties from any which had been hitherto admitted into that class of mineral bodies. The result of his experiments and observations, he communicated to the public, through Crell's Journal in 1791. Klaproth of Berlin, afterwards in examining the red schorl of Hungary, recognized the presence of the same metal before discovered by Mr. Gregor, since which time Titanium has been found in other mineral bodies.

According to Lampadius,\* Titanium in its metallic state, is of a dark copper red colour, and of considerable lustre; is brittle, and when thin, elastic. When exposed to the air, it tarnishes; and when heated, absorbs oxigene. It then becomes blue, it detonates with nitrat of potash; is highly infusible. All the strong acids act upon it with energy.

It will be unnecessary here to mention the various characters which designate the ores of Titanium. We shall only observe that when the external characters are so indistinctly marked as to admit of a doubt, if a portion of the ore finely powdered be fused with four times its weight of caustic potash, and the fused mass digested several times with water, a whitish powder (oxide of Titanium) will fall to the bottom.

The forms under which Titanium has been found in the United States, are

*The Oxide.*


*The ferruginous Oxide.*

*The Silico-calcareous Oxide.*

\* Nicholson's Journal, vi, 62.

OXIDE OF TITANIUM.

**SYNONIMES.** Titane oxydé, *Haüy*. Schorl rouge, *Romé de Lisle*. Oxyde rouge de Titanium, *Delametherie*. Rutil, *Werner*. Rutile, *Jameson*. Titanite, *Kirwan*. Titane Ruthile, *Brogniart*.



The specimens described form a part of the writer's Cabinet of the mineral productions of the United States.

No. 1.

Small quadrangular prismatic, nearly acicular semi-transparent crystals of the oxide of Titanium, of a dark blood-red colour, variously recumbent on a granitic aggregate of compact felspar, bluish quartz and brown mica.

No. 2.

Small dark red semi-transparent double crystal of the oxide of Titanium, being two four-sided prisms, so connected at their bases, as to form a jointed crystal (*Geniculé of Haüy*) (P. II, Fig. 1.) the surface highly resplendent, lying on an aggregate of compact felspar, granular carbonate of lime and bluish quartz.

No. 3.

Large amorphous blood-red oxide of Titanium, on white felspar, with dark brown mica and granular carbonate of lime.

No. 4.

Light red acicular oxide of Titanium, imbedded in bluish

quartz, with transparent crystallized felspar, (adularia) and brown mica.

The above specimens, 1, 2, 3, and 4, are from the Island of New-York. They were found in the lime-stone ridge which crosses the Island at its northern extremity, near Kingsbridge. The lime-stone, which is primitive, has running through it in different directions, veins from one to three or four inches thick, composed of quartz, felspar, mica, and granular lime-stone: through which the oxide of Titanium is sparingly disseminated. The quartz is of the fœtid kind, giving out an unpleasant odour on being fractured.

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No. 5.

Amorphous oxide of Titanium of a dark grey red colour, translucent on the edges, having a strong metallic lustre, imbedded in a white fine-grained carbonate of lime.

No. 6.

A detached crystal of oxide of Titanium, in colour similar to No. 5, and in figure resembling No. 2, longitudinally striated.

The specimens 5 and 6 were sometime ago presented to me by Mr. —. I regret however, that from an idea of their supposed value, no further information relative to their locality could be obtained, than an assurance that they were found in a marble quarry on the Hudson river.

No. 7.

Compact amorphous oxide of Titanium of a blood-red colour, imbedded in milk-white quartz.

No. 8.

Massive red granular red oxide of Titanium.

Nos. 7 and 8, are from the vicinity of Richmond, Virginia. They were presented to me by Mr. Cloud, of the United States mint, who informs me that this variety of the oxide of Titanium is there found in large quantity.

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No. 9.

Dark red oxide of Titanium in prismatic crystals longitudinally striated, the surface splendent and somewhat iridescent, imbedded in white semi-transparent quartz, part granular and part compact.

For the specimen No. 9, I am indebted to Dr. John F. Waterhouse, who first discovered this variety of the oxide of Titanium at Worthington, (Massachusetts,) from whom I learn that the quartz which contains it, occurs in beds of hornblende slate.

No. 10.

Light red prismatic and laminated oxide of Titanium, in yellowish quartz.

This specimen, No. 10, the laminated part of which approaches to the reticulated variety found on the Swiss Alps, is from the vicinity of Baltimore, where it was discovered by Mr. R. Gilmor, jun.

## No. 11.

Small steel grey crystals of the oxide of Titanium, in hexaedral prisms, rounded at the extremities (see Pl. II. Fig. 2.) having a strong metallic lustre, imbedded in bluish quartz.

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This specimen is part of a large insulated mass of quartz, found near the Schuyler copper mines, in Bergen county, New-Jersey, by Mr. Chilton, who made a diligent but ineffectual search to discover it *in situ*.

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## FERRUGINOUS OXIDE OF TITANIUM.

SYNONIMES. Titane Oxydé ferrifere, *Hauy*. Menachinite, *Kirwan*.

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## No. 1.

Amorphous black compact ferruginous oxide of Titanium, with red oxide of Titanium.

## No. 2.

Black granular ferruginous oxide of Titanium, with compact red oxide of Titanium.

These specimens are from the vicinity of Richmond, Virginia, and accompany the red oxide before described.

SILICO-CALCAREOUS OXIDE OF TITANIUM.

SYNONIMES. Titane Siliceo calcaire, *Haüy*. Calcareo Siliceous Titanitic Ore, *Kirwan*. Rutilite, *Jameson*. Titane Nigrine, *Brogniart*.

No. 1.

Small semi-transparent yellowish crystals of the silico calcareous oxide of Titanium in rhomboidal prisms (Pl. II, Fig. 3,) imbedded in white lamellated carbonate of lime, which has a pearly lustre, with dark bluish carburet of iron.

This specimen is from Newton, New-Jersey, where the limestone forms considerable beds, and frequently contains crystallized mica.

No. 2.

Large yellowish grey crystals of silico calcareous oxide of Titanium in rhomboidal prisms, terminated by diaedral summits, (Pl. II, Fig. 4) imbedded in an aggregate of white granular and lamellated felspar; having also imbedded dark green hornblende, and foliated carburet of Iron.

This variety of the Silico calcareous oxide of Titanium, was discovered by Col. Gibbs at Tyconderoga.

No. 3.

Large clove-brown crystals of the silico calcareous oxide of Titanium, in form similar to No. 2, imbedded in a rock, composed of large prismatic crystals of bottle-green

hornblende, white semi-transparent compact felspar, with brilliant foliated carburet of iron.

This specimen, which was presented to me by Mr. Abeel, sen. is from the vicinity of Lake George.

No. 4.

Silico calcareous oxide of Titanium, in colour and figure similar to No. 2, imbedded in compact opake felspar, with dark green hornblende.

No. 5.

The same imbedded in dark bottle-green hornblende.

No. 6.

The same in crystals of the largest size, in a matrix composed of yellowish green compact felspar, which appears to derive its colour from the hornblende, with which it abounds, and into which, indeed, it appears to pass.

These specimens, Nos. 4, 5, and 6, are from Staten-Island, and were presented to me by Drs. Prince and Bloodgood, of this city. They were found by these gentlemen in a large insulated rock mass, which was thrown out at the site of Fort Richmond, when the works were first commenced.

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No. 7.

Silico calcareous oxide of Titanium, in form and colour similar to No. 6, imbedded in an aggregate of flesh-coloured felspar, bluish quartz, and green hornblende.

This specimen is from the vicinity of Peekskill, (New-York) and was discovered by Dr. William Langstaff.

The specimens 4, 5, 6, and 7, greatly resemble those of the same substance from Arendal in Norway, which enabled the celebrated Haüy to determine his mechanical division, and in which the geometry of crystallization was confirmed by the masterly analysis of Vauquelin.

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No. 8.

Small brilliant crystals, in form similar to No. 2, of a light dove colour, imbedded in granular primitive carbonate of lime, from the marble quarry at Kingsbridge, Island of New-York.

No. 9.

Wax-yellow semi-transparent silico calcareous oxide of Titanium, in flat rhomboidal prisms, having the alternate and opposite obtuse solid angle at each base deeply and obliquely bevelled, so as to form at each extremity a triedral pyramid. (Pl. II, Fig. 5.) These crystals which are resplendent and sometimes iridescent, are imbedded in an aggregate of small black prismatic hornblende, and whitish lamellated felspar, sometimes forming large tabellated crystals, having a foliated cross fracture. In some parts, small, white, opaque, partly decomposed crystals of felspar, are also imbedded.

No. 10.

Small topazine yellow transparent crystals of silico calcareous oxide of Titanium, in form similar to No. 9, and in the same matrix, except that the felspar which is red is

more compact, and in some parts appears to pass into the andaluzite or felspar apyre of Haüy.

No 9 and 10, are from Wantage, Sussex county, New-Jersey. This aggregate forms a vein from 1 to 3 and 4 feet thick, which traverses the granitic mountain, near Mr. Beamer's, about 12 miles from Hamburg.

In addition to the above, it may be observed that Titanium has been met with in other parts of the United States. According to Haüy, the oxide occurs in South-Carolina.\* In the Cabinet of the Hon. Dr. Seybert, is a specimen from Delaware. Professor Cleaveland informs me that it has been found at Topsham, in the District of Maine. In Pennsylvania and North-Carolina it also occurs, as will appear by the following extract of a letter which I received a short time since from Mr. Cloud.—“ I have lately received from Delaware county in this state, (Pennsylvania), a specimen of rock crystal, (of the variety called smoky topaz,) with a number of beautiful crystals of the red oxide of Titanium adhering to its surface, and fibres of the ore shooting through its body. It was ploughed up in a field where the amethyst is frequently found in the same way. May not Titanium be the colouring matter of the amethyst? I have in my collection, crystals of the red oxide of Titanium, from the back part of North-Carolina, where I am informed they are found in abundance, and of large size :—(I have not been able to learn the precise locality.) Crystals of silico calcareous Titanium are found in the felspar of the rock at the Falls of the Schuylkill, and in the primitive limestone in Chester county, near the Grove meeting-house, where the red oxide also occurs.” According to Mr. Gilmor, the silico calcareous oxide is found in the granite rocks near Baltimore.

\* *Traité de Minéralogie*, Tom. IV. P. 302.

NOTE.

From the above it appears, that the ores of Titanium are of very frequent occurrence within the United States. The locality of the specimens described, as far as could be ascertained, tend to confirm the opinion of Werner as to Titanium being one of the oldest of the metals. Should this metal hereafter be applied extensively to the arts, it is presumed that the United States will be enabled to furnish any quantity that may be required.

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PUBLICATIONS.

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*Hayden's Geological Sketch of Baltimore.*

(Baltimore Medical and Philosophical Journal, Vol. I.)

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WE embrace the present opportunity of extracting from the above valuable paper, and laying before our readers, the following interesting account of the *Chromate of Iron*, which we mentioned in a former number was the material from which was obtained the acid, used in the manufacture of that beautiful pigment, the *chromate of lead*, or *chromic yellow*.

This ore, according to Mr. Hayden, occurs on the Bare Hills, near Baltimore, which are thus described :

“ The range of these hills is nearly in an easterly and westerly direction ; not high nor much broken. The eastern part of the serpentine range terminates within a small distance of the creek which is called Jones's Falls. On

the north side they are bounded, in part, by an auxiliary branch of the same creek. When ascending them on the south side, nothing strikingly interesting presents itself in the general view; but when approached from the east side, or viewed from their summits at different points, or from the road on the north side, the mind seems involuntarily to feel the impulse of melancholy. For the thinly scattered soil, which has been, perhaps for ages, slowly accumulating from a few decayed vegetables which some friendly breeze has borne upon its barren surface, is scarce sufficient to nourish a few scattered tufts of grass. A gloomy silence pervades around, while every rood on the serpentine range bears the most decided marks of sterility. The stones which cover its surface in many places, and of which the hills are mostly composed, bear the evident marks of a partial decomposition, which gives the whole a smoky, brown appearance, as if it had been subjected to perpetual sulphurous exhalations, or steams of subterraneous fires. If a fratricidal Cain had here committed his Heaven-insulting deed, we need not wonder; it bears so much the appearance of having experienced the unappeased wrath, the eternal curse of an offended Deity. Scarce a solitary lizard, or a creeping ant is here seen, seeking among the mouldering serpentine a peaceful borough in which to deposit its daily spoils, and screen its tender offspring from the chilling blasts of winter's wind, which sweeps in triumph over this dreary waste. Besides the interest which it excites on account of its gloomy aspect, few districts present a more interesting field in a mineralogical point of view, than the one under consideration. The principal eminence appears to be composed mostly of an inferior kind of serpentine, even that which is raised from the depth of forty feet below the surface, is of a loose, and somewhat friable texture; and at the same time intermixed with a variety of substances of the magnesian genus; such as the amianthus, asbestos, steatites,

common and foliated ; carbonate of magnesia, amorphous and crystallized ; a species of lardite ; noble serpentine, and several other interesting substances not sufficiently defined.

But the most important substance that has yet, I believe, been found at this place, is the chromate of iron, of which there are immense quantities.

This interesting substance, of which much has been said in different parts of the world, appears at this place evidently under three different forms, or rather different states. At the place where it has been principally sought for and raised for the different purposes to which it has been converted, it appears in masses pretty compactly formed and of various sizes, as it may happen to be broken up, and among which is intermixed more or less of talc, steatites, &c. Its colour inclining to black, or dark brown. Its fracture, in some instances, appears shattered, in others, conchoidal, and in others somewhat foliated, presenting smooth surfaces, having somewhat the resemblance of brown blend, for which this substance was mistaken in France, by citizen Pontier, who first discovered it ; but which by the analysis of citizen Tassaert, was proved to be the chromate of iron.

At the same place it is also found perfectly granulated, in a gangue apparently of indurated steatites, yet considerably harder. In this substance it appears in innumerable grains of an irregular form, separate from each other, and from the size of a grain of mustard to that of a kernel of pepper, though the latter are rare.

In the next place it is found crystallized in perfect and well defined crystals of an octaedral form, and from the size of a grain of mustard to those whose facets are nearly one eighth of an inch in length.\*

\* Those crystals have, for some time, been considered as octaedral iron ore ; but they have recently been tested in this city, (Baltimore) and proved decidedly to be the chromate of iron.

Those crystals have been observed as yet, only on the eastern part of the hill which constitutes the serpentine range, about one quarter of a mile east from where the amorphous kind is raised or dug up. On this part of the hill are several considerable ravines or gullies, occasioned by water, which, in the course of time, has worn the serpentine, in some places to a considerable depth. In these gullies, the crystals are found washed down and mixed with sand, and a considerable quantity of the granulated chromate of iron.

The exact locality of those crystals, and the granulated chromate of iron that accompanies them at this place, I have not as yet been able to determine ; but, from some indications, I am strongly inclined to believe that they were once imbedded in the thick veins of green indurated talc, which, in many places in the sides of those gullies, runs through the serpentine.

Since crystallized chromate of iron is, as far as we have any knowledge, a novelty in the mineral kingdom, permit me to hazard a few remarks on its characters.

Its colour is mostly black, inclining in some degree to steel grey ; when held in a bright light, it often presents the colours of tempered steel. Surface of the facets of the crystal, untarnished, and smooth as if highly polished. Transparency, except in some instances when laid upon a sheet of white paper and in the light of the sun, a rich, deep blood-red colour is perceivable. The irregular fracture of the crystals, conchoidal, and vitreous, treated with the blow pipe, infusible without addition ; with borax, it gives a bead of a beautiful green. Rather brittle and easily broken, as must appear, for many of the crystals are mutilated, probably by the pebbles rolling over the rocks, and falling on them.

Magnetic in a considerable degree.

Pulverized, the powder or dust is of an ash grey.

The form of those crystals, although perfect octaedrons, and regular pyramids in many instances, it does not follow

that they are uniformly so in all. In some, the angles of the pyramids are considerably more salient than in others. In some, the base, instead of being rectangular, is sometimes rhomboidal. In others, the bases, though rectangular, are oblong. In others, one of the pyramids is considerably depressed or flattened; with others, both are flattened.

The primitive, integral form of those crystals, is tetrahedral. This may be ascertained by any person who is desirous of trying the experiment; for the crystals are divisible, parallel only to the facets of the pyramids."

The Chromate of Iron has lately been found in Pennsylvania, (we believe Chester,) under circumstances and possessing characters very similar to that from the Bare hills.

Since it has been ascertained that this combination of Iron with chromic acid is subject to the laws of crystallization, it occurred to several of the mineralogists of Baltimore, that, in some instances, where it was supposed that the metal was in a state of mere oxidation, it might be combined with chromic acid. This was so strongly impressed on the mind of Mr. Gilmor, that he was induced to institute some experiments, with a view of ascertaining the fact. The subjects of experiment were small octahedral crystals of what we have hitherto considered oxide of iron, from the magnesian rocks at Hoboken, (N. J.) which, on being submitted to the blow-pipe, gave to borate of soda that beautiful emerald green colour which so eminently demonstrates the presence of chrome. As almost every cabinet of mineralogy contains specimens of what is generally denominated octahedral iron ore, we should submit the propriety of such trials, as may ascertain whether chrome may not in some instances form a constituent principle of these ores.

From the very interesting paper before us, from which we have so freely extracted, we are induced to hope that

the chromate of iron, hitherto so rare in Europe, will, from its abundance in the United States, afford an ample and promising field to the manufacturing speculator.

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*On the Sand hills of Cape Henry in Virginia. By B. HENRY  
LATROBE, Esq.*

Transactions Am. Ph. Society, vol. iv, p. 439.

**F**ROM the falls of the great rivers of Virginia over the out-runings of the granite strata, the general level of the land gradually approaches the level of the ocean. At the falls it is elevated from 150 to 200 feet above the tide: on the sea shore at Cape Henry, the original coast rises not more than 15 feet above high water mark.

That the whole of this extensive country, from the falls to the coast, is factitious, and of Neptunian origin, appears far from being hypothetical; and the fossil teeth and bones, which accompany this memoir,\* and which with many

\* The teeth appear to be those of a shark. They are highly enamelled and extremely sharp: their roots are perfectly sound and entire, and the minute and almost transparent jags of many of them are as perfect as the rest. They are found in every well, dug in or near Richmond, to a sufficient depth; and, as I am informed, in every deep well for many miles below the city. The stratum in which they lie consists of highly sulphurated blue clay, abounding in pyrites, and which has the appearance of having been mud. They were first discovered in the beds of rivulets, which had worn their channels to the depth of this stratum; and obtained the name of *Indian Dart-points* in the same manner, as the immense oyster-beds, which have been quitted by the ocean, are vulgarly called *Indian oyster-banks*.

The bones were dug from the same stratum. Among them are two out of six bones, which formed a *parv* of some animal unknown to me. Many very sound vertebrae of fish, and a remarkably perfect thigh bone of a large bird have been in my possession.

hundred more, were dug out of a well at Richmond, from the depth of 71 feet, prove that the deposition of the superstrata is not of a date sufficiently removed to have destroyed the soft and almost cartilaginous part of the joints, or to have injured the enamel of the teeth. The Neptunian theory of geogeny, has now very generally taken place of the old volcanic system, and, as far as conjecture and hypothesis can forward science, it is certainly more generally applicable. But along the coast of Virginia,\* a process is going forward, the result of which will be exactly similar, and in which water has no immediate share.

The shore, and the bed of the Atlantic near the shore, consist of a fine sand. The daily action of the flood tide carries a certain quantity of this sand above high water mark, which being dried by the sun and air, is carried further in land by the winds. The most violent winds on this coast, blow from the points between the N. West and the East; and besides, a gentle easterly breeze prevails the whole summer, during some part of almost every day. This easterly wind, which is in fact a trade wind, is felt as high as Williamsburg. It is said to be felt, at this day, higher in land than formerly, and to be annually extending its influence; and it will no doubt, when the woods shall be more cleared away, blow health and coolness over a portion of lower Virginia, which is now considered as extremely unhealthy.

These easterly winds blowing during the driest and hottest season of the year, carry forward the greatest quantity of sand, and have amassed hills, which now extend about a mile from the beach. The natural level of the land, elevated little more than 10 feet above high water mark, has

\* I speak only of the coast of Virginia at Cape Henry; for although I have the best reason to believe that the same natural process has produced all the sand banks, islands, and sand hills from the Delaware to Florida: I have only examined that part of the coast, which is the subject of the present memoir.

a very gentle declivity to the east. It is now a swamp \* of about five miles square (25 square miles.) The soil below the surface, is a white loamy sand, and if the water falling upon, or rising in it, had a free discharge to the ocean, it would probably be perfectly dry : this, however, the sand hills prevent, and the water is discharged into the sea to the southward, and into the mouth of the Chesapeake to the northward, by small creeks, which find vent from the westerly extremities of the swamp. Lynhaven creek is the most considerable of these drains. The swamp, or as the neighbouring inhabitants call it, the Desert, is overgrown with aquatic trees and shrubs ; the gum, (*L. styraciflua*) the cypress (*cup. disticha*) the maple (*acer rubrum*) the tree improperly called the sycamore (*platanus occidentalis*) the magnolia glauca, the wax myrtle (*myrica cerifera*) and the reed, (*ar. tecta*) are the principal. Of these many thousands are already buried in the sand, which overtops their summits, and threatens the whole forest with ruin. Their destruction is slow, but inevitable. Upon the extreme edge of the sand hills towards the swamp, the wind opposed by the tops of the trees, forms an eddy : the sand carried along with it is precipitated, and runs down the bank into the swamp. Its slope is very accurately in an angle of 45°. By gradual accumulation, the hill climbs up their trunks, they wither slowly, and before they are entirely buried, they die. Most of them lose all their branches, and nothing but the trunk remains to be covered with sand, but some of the cypress retain life to the last.†

\* By a swamp I exclusively mean a piece of ground, the surface of which is wet and soft, but which has a sound bottom. In this it differs from the Dismal Swamp, much of which is a *bog* or *morass*. Into the latter, a pole of any manageable length may be forced with great ease.

† That the swamp with its trees extended to the sea coast, perhaps *within* a century, is very evident from this circumstance : between the summit of the sand hills and the sea shore, and more especially on the Chesapeake side, the un-

The Desert abounds in deer, bears, racoons, and opossums. Its skirts are more thickly peopled than the sterility of the soil would give reason to suppose; but the inexhaustible abundance of fish and oysters in the creeks, and the game, render it easy to support a family.

The lighthouse,\* which was built about sixteen years ago, is an octangular truncated pyramid of eight sides, rising 90 feet to the light, and sunk 18 feet below the basement course. Within a few yards of the lighthouse, is the keeper's dwelling, a wooden building of two stories. Both are surrounded by a platform of plank; and, without any such design in the architect, this platform has preserved both these buildings from being buried in the sand.

When the lighthouse was built, it was placed upon the highest sand hill at the Cape. Its distance from the beach may be 6 or 7 hundred yards, and the elevation of its base above high water, not less than 90 feet. At that time there was from the foot of the building, the most expanded view of the ocean, the Desert, the Chesapeake and its eastern shore. At present, a mound of sand surrounds them, which overtops the keeper's dwelling, and has buried his kitchen to the eaves. The platform, which was laid upon the former level of the sand, is an accurate standard from whence to ascertain its accumulation. The winds meeting in their course the elevated tower of the light, form a perpetual whirl around it, which licks up the sand from the

decayed, though mostly *dead* bodies of trees still appear in great numbers. Being on the windward side of the sand hills, they have not been more than half buried. At the lighthouse there are none of the trees, but to the westward and southward are many.

\* It is a good solid building of Rappahannoc freestone, but has the unpardonable fault of a wooden stair case, which being necessarily soaked with oil exposes the light to the perpetual risk of destruction by fire. Such an accident might be attended with an incalculable loss of lives and property: the mouth of the Chesapeake being perhaps the inlet to more ships than any other in the United States.

smooth surface of the timber, and heaps it around in the form of a basin. Where the platform ceases, the sand accumulates. The sandy rim, while it protects the keeper from the storms, renders his habitation one of the dreariest abodes imaginable. This rim is sometimes higher, at others lower, according to the direction and strength of the wind. Since the establishment of the light, the hills have risen about 20 feet in height (measuring from the platform) and have proceeded into the Desert about 350 yards, from a spot pointed out to me by the keeper. I stepped the distance as well as I could, while at every step I sunk up to my ankles into the sand. The height of the hill at the swamp, is between 70 and 80 feet perpendicularly. It is higher nearer the sea, the inner edge being rounded off, and I think at its highest point, it cannot be less than 100 feet above high water mark. If the hills advance at an equal ratio for 20 or 30 years more, they will swallow up the whole swamp, and render the coast a desert indeed, for not a blade of grass finds nutriment upon the sand.

Should this event take place, and some future philosopher attend the digging of a well *in the high sandy country, on the coast of Virginia*, his curiosity would be excited by fossil wood, 100 feet below the surface. He would there discover a bed of vegetable and animal exuviae, and going home, he might erect upon very plausible ground, a very good-looking hypothesis of a deluge, sweeping the whole upper country of its sand, and depositing it along the line of its conflict with the waves of the ocean.

*On the Topaz of Scotland. By Professor JAMESON.*

Memoirs of the Wernerian Natural History Society, Vol. I, P. 445.

**I**T is said that the greater number of the precious stones have been, at different times, discovered in the mountainous districts of Scotland; but hitherto no accurate account of them has been published. This is owing to a deficiency of mineralogical skill, and the interested motives of the discoverers, who have always endeavoured to conceal the knowledge of the spots where these stones have been found. According to the jewellers and lapidaries of Edinburgh, the *ruby* occurs at the Ely in Fifeshire, also near Portsoy in Banffshire, in Inverness-shire, and Aberdeenshire: the *emerald* at the mountains of Cairngorm in Aberdeenshire: The *aqua marine*, or precious beryl, at Invercauld, and in the Orkney Islands: The *sapphire* in different places of the Highlands, as at Benachie and Invercauld in Aberdeenshire, and Portsoy in Banffshire: The *amethyst* at Invercauld, and in Strathspey, and other parts of Scotland: The *garnet* abundantly in Aberdeenshire, and other parts of Scotland: and, lastly, the *topaz*, is said to occur frequently in Strathspey, at Invercauld in Aberdeenshire, Cairngorm, and in the Isle of Arran.

But are all these true precious stones?—The ruby of the Ely, and the other places already mentioned, cannot be referred either to the spinelle ruby, or the red sapphire, which is the oriental ruby of jewellers. The mineral found at the Ely is not unlike the Cinnamon-stone of Werner, which I consider as a species of the garnet family. The Emerald of Cairngorm and Strathspey, and the Aqua marine of Invercauld, are varieties of precious beryl; and the aqua marine of the Orkney Islands, if the specimens in the late Dr.

Walker's cabinet be truly from that quarter, is also precious beryl. The Sapphire of the Highlands, from the examination of specimens in the possession of Mr. Deuchar, is a pale, celandine-green coloured topaz. The Amethyst is the true amethyst of mineralogists. The Topaz of Cairngorm, Isle of Arran, and other places, is rock-crystal of various colours, as yellowish-white, clove-brown, wine-yellow, and orange-yellow. The clove-brown varieties are named *smoke-topaz*; the orange and wine-yellow varieties are sometimes sold as true topaz. The Garnet is the precious garnet of Werner; the Syrian or oriental garnet of many jewellers.

It thus appears, that precious beryl, topaz, amethyst, and precious garnet, are the only true gems hitherto discovered in Scotland. But the topaz of Scotland has been considered as a variety of sapphire, and its true nature was not understood until lately, when its characters were fully exhibited in a fine series of topaz-crystals of remarkable size, brought from the upper part of Aberdeenshire to Edinburgh, and now in the possession of Mr. White, lapidary.

#### TOPAZ OF ABERDEENSHIRE.

Colour greenish white, and intermediate between mountain-green and celandine-green.

Is slightly opalescent.

The form of the largest crystal is an oblique eight-sided prism, deeply bevelled at the extremity; the bevelling planes set on the acute lateral edges; the proper edge of the bevelment truncated, and the angle formed by the meeting of the bevelling plane and the lateral planes bevelled.

The surface of the crystal is rough, owing to attrition.

Internal lustre splendid and vitreous. Cross fracture distinctly foliated; longitudinal fracture perfect conchoidal. Is semi-transparent, inclining to translucent. Harder than precious beryl; but not so hard as spinelle. Specific gravity 3,570, (*Thomson.*)

This crystal weighs 7 ounces 3 pennyweights  $18\frac{1}{2}$  grains Troy ; and a fragment of a crystal from the same tract of country, now in the possession of Mr. Farquharson of Invercauld, weighs 1 pound 3 ounces 8 drams, and  $8\frac{1}{2}$  grains Troy weight.

These are the largest topazes hitherto found. In the National Museum at Paris, which is the most extensive in Europe, the largest topaz is one weighing 4 ounces 6 gros.\*

The discovery of so valuable a gem in this country, naturally leads us to inquire, in what situation it is found, and whether or not it is likely to occur in considerable quantity. Unfortunately, the data for answering these questions are not complete : we must, therefore, at present rest satisfied with a short statement of the geognostic relations of the topaz of foreign countries, which, when compared with the accounts given of our topaz, will enable us to guess at its probable geognostic situation.

This gem occurs in considerable quantity in the Electorate of Saxony, in a particular species of mountain-rock, denominated, by Werner, *Topaz-rock*, because topaz is one of its essential constituent parts. Besides forming an essential ingredient of topaz-rock, it also occurs in it in drusy cavities, along with quartz crystals, and lithomarge. In Bohemia and Saxony, it occurs in veins that-traverse gneiss and mica-slate. These veins are generally narrow, intimately connected with the rock they traverse, of very old formation, and contain, besides topaz, also tin-stone, arsenic pyrites, sometimes copper pyrites, apatite, fluor-spar, quartz, and steatite. The Siberian topaz appears to occur in veins in primitive mountains, and probably also in large drusy cavities, in rocks of a very old formation.

About 25 leagues north from Catharinenburgh, in the

\* It is said that there is a topaz in the rich collection of Sir John St. Aubyn, the size of a fist.

Uralian Mountains, topaz is found in considerable quantity in a kind of granite, resembling that variety known under the name of *pierre graphique*. There, it is said to occur in drusy-cavities, along with quartz and precious beryl. It is also found in the opposite extremity of Siberia, in a mountain named Odon-Tschelon, in the province of Dauria, where it occurs in druses along with precious beryl. The topazes of Odon-Tschelon, and, indeed, of Siberia in general, are generally snow-white, frequently celandine-green, and very rarely of a beautiful blue, resembling the sapphire; and some varieties exhibit a kind of opalescence. The Brazilian, and sometimes also the Saxon topaz, are found in alluvial soil;\* and the topaz of Pegu, Ceylon, Hawkesbury River in New Holland, and Cape Barren Island in Basses Straits,† has a similar geognostic situation.‡

Such are the geognostic relations of the topazes of foreign countries. The topaz of Scotland has hitherto been found only in alluvial soil, along with uncommonly large rock-crystals, and middle-sized crystals of precious beryl, and in a tract of country, as far as we know, entirely composed of primitive rocks; and hence it is highly probable, that its original repository is in primitive country. But in which of the primitive rocks is it probable that the topaz is contained, and in what kind of repository does it occur? The tract of country where our topaz is found, is said to be principally composed of granite, and to contain, besides,

\* Topaz has lately been found imbedded, in small crystals, in transition rocks.

† Dr. Monro junior presented me with a rolled piece of topaz, said to be from Hawkesbury river; and Captain Laskey, with a crystal of the same gem from Cape Barren Island, in Basses Straits.

The topaz of Basses Straits, as my learned friend Mr. R. Brown informs me, was first discovered by Mr. Humphry junior, who was some years ago sent out by Government to examine the mineralogy of New Holland and Van Diemen's Island.

‡ In the collection of the Museum of Natural History at Paris, there is a large rock crystal, containing reddish-coloured crystals of topaz from Brazil.

considerable portions of gneiss and mica-slate. This being the case, it is probable the topaz will be found in one, or possibly in all these different rocks. It may, however, be alleged, that probably the topaz-rock also occurs there, and that the topaz may be derived from it. But the topaz-rock is one of the rarest of the mountain-rocks, and the topaz which it contains has always a yellow colour, and differs somewhat in regular form from the topaz of Scotland; it is also smaller, and is never accompanied with rock-crystal or precious beryl. Hence it is not probable, that the topaz-rock occurs in the district of which we are treating. If, then, the topaz-rock is wanting, it will be inquired, in which of the primitive rocks already mentioned we are to look for it? Some may be of opinion that it occurs in veins, in gneiss or mica-slate, as is the case with the Bohemian, and certain varieties of the Saxon topaz. The want of all the accompanying minerals, as tin-stone, arsenic pyrites, copper pyrites, fluor-spar, &c. render this supposition improbable. But the topaz of Siberia agrees with that found in Aberdeenshire, in having green and white as its most frequent colour; in opalescence; in figure, being generally bevelled at the extremity; in size, the largest topazes being found in Siberia; and in accompanying minerals, which are usually rock-crystal and precious beryl.

Lastly, the Siberian topaz is said to occur in drusy cavities or veins in granite, and in considerable quantity. If this account be correct, we may infer that the Aberdeenshire topaz will be found in drusy cavities or veins in granite, and in considerable quantity.

I trust the conjecture I have now suggested, will induce mineralogists to examine the tract of country where this interesting mineral is found.\*

\* Since this paper was read to the Society, I have been informed by my friend Colonel Imrie, that the large fragment of topaz in the possession of Mr. Farquharson of Invercauld, was broken from a mass of granite.

Another topaz has been found near Invercauld, in Aberdeenshire. Its weight, as communicated to me by Colonel Imrie, is 3420 grains, or 7 ounces 2 pennyweights and 12 grains : Its specific gravity 3.56. It is said, that a distinct crystal, heavier than the preceding one, has been found in the same county, and is now in the possession of a gentleman in Aberdeen.

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## INTELLIGENCE.

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### GALVANIC BATTERY.

ON Saturday, July 2d, 1813, J. G. Children, Esq. put in action the greatest galvanic battery that has ever been constructed. It consisted of 20 pair of copper and zinc plates, each plate 6 feet in length, 2 feet 8 inches in breadth. Each pair was fixed together at the top by pieces of lead cut into ribbons. A separate wooden cell was constructed for each pair. The plates were suspended from a wooden beam fixed at the ceiling, and were so hung by means of counterpoises that they could be easily raised or let down into the cells. The cells were filled with water, containing a mixture of sulphuric and nitric acids. At first the acids amounted to 1-60th of the water ; but more was gradually added till it amounted to the 30th. Leaden pipes were attached to the two extremities of the battery, and conveyed the electricity out of doors to an adjoining shade, where the experiments were made. The power of this battery was very great ; though I am not certain whether it increased in proportion to the size of the plates. It ignited about 6 feet in length of thick platinum wire. The heat produced was very intense. It melted platinum with great facility. Iridium was likewise melted into a globule, and proved to be a brittle metal.

The ore of iridium and osmium was likewise melted, but not so completely. Charcoal was kept in a white heat in chlorine gas, and in phosgene gas ; but no change took place in either of these gases. Neither tungsten nor uranium underwent any change. A very singular fact was pointed out by the sagacity of Dr. Wollaston, and succeeded upon trial. A greater length of thick platinum wire was ignited than of platinum wire of a much smaller size. This Dr. Wollaston had previously ascertained in his own minute galvanic batteries, consisting of a single pair of small plates.

*Annals of Philosophy, No. VIII.*

#### THE FAROE ISLANDS,

THESE Islands have long been considered as highly worthy the attention of naturalists, particularly as regards their geology and mineralogy ; and as every information respecting them will be deemed interesting, we beg leave to present to our readers, the following extract of a letter, which we have received from our learned friend and correspondent Thomas Allan, Esq. of Edinburgh.

“ You will naturally be anxious to know what we saw in Faroe ; of this I shall try to give you a sketch in as few words as possible. Sir George Mackenzie having been offered accommodations in one of his majesty’s vessels, in case he had any inclination to visit the Faroe Islands, asked me to accompany him, which I most readily consented to do. About the end of May (1812) we sailed from Leith in the *Clio*, and after clearing the Firth, reached Thorshaven the capital in 60 hours ; the distance is 500 miles, so that we were very fortunate in our run.

The Islands are 18 in number inhabited, besides several small ones uninhabited. They extend about 60 miles from N. to S. The largest is Stromoe, 25 miles long, by about 8 in the widest part.

From one end to the other they are completely composed of trap-rocks, greenstone, basalt, amygdaloid and tuff. These are arranged in beds wonderfully regular, and rising to the north and west. The highest mountain is in Stromoe, and may be about 3000 feet. We measured one in Osterve which is 2825 feet. On the north west side, the coast presents some of the most tremendous cliffs I ever saw : one I measured and found it to be 1134 feet. This cliff is in Osterve, and is called the Kodlen ; there is another near it in Stromoe called the Mylling, which is considered the highest in Faroe, and may be about one third loftier than the one I measured. These are entirely composed of trap ; I did not see an atom of stratification in the country.

In Suderoe there is coal. We did not visit that Island, but, from the similarity of its structure, as seen from a distance, it in every probability is essentially the same as the other islands, the coal resembling that of Ballintory in Antrim, as also that which occurs in Skye. These trap-rocks are intersected in every direction with dykes which are generally nearly perpendicular, sometimes perfectly so.

Upon the zeolitic amygdaloid we saw some of the most evident marks of fusion. Of minerals we got none but zeolites, calcedonies, and some native copper. Of the former I have got some mezotype far finer than any I ever saw, in groups of transparent diverging needles from one to two inches long, perfectly crystallized and terminated. Of the stilbite I also got some magnificent specimens, one I think new in large cubes ; these are sometimes elongated, forming the rectangular prism, sometimes they are truncated on all the solid angles so as to present the *cube octaedre*. They are semi-transparent, and where they have been affected by the weather, are snow-white. One of the crystals I got of this is an inch long, and about  $\frac{3}{4}$  thick. The calcedonies are difficult to procure, but are some of them magnificent. I saw in the rock the remains of one that had been four feet

in length and about two in the widest part. In the cavity of one of them I found the mezotype finely crystallized. The situation of the copper is the most singular, it occurs disseminated in a bed of trap and zeolitic amygdaloid beautifully crystallized, and sometimes forming the centre of a very fine zeolite. This is a curious fact, it was on this variety of trap that we saw such evident marks of fusion, and no copper from the veins of Cornwall can present crystallizations more perfect.

We remained five weeks in the Islands, and had as rapid a voyage home as we had out."

#### ZIRCON FOUND IN SCOTLAND.

PROFESSOR JAMESON of Edinburgh, in a letter to the Editor, mentions his having discovered this rare mineral in Galloway imbedded in gneiss.

#### GEOLOGY OF LONG ISLAND.

WE have received a Letter from the Hon. Professor Mitchill, containing the following additional facts illustrating the modern and alluvial character of Long Island.

"In the third number of the American Mineralogical Journal, you published a paper of mine, shewing that the *whole* of Nassau or Long Island, in the State of New-York, was *alluvial*, and not one half alluvial and the other primitive, as Messrs. Volney and Maclure have taught. I have additional facts, which I have now the pleasure to make known to you.

1. *North Hempstead in Queen's County.*—A well was dug during the summer of 1813, at Great Neck, for Messrs. William and John Mott. The place is, at least, three miles north of the ridge of hills at Success. They penetrated the

earth to a great depth and at length ordered the work to be discontinued, without finding water. The hole was accordingly covered up. The stratification was nearly as follows, to wit ; hard earth, rather reddish, and requiring the pick-axe, 9 feet ; light-coloured sand, free and loose, 21 feet ; dark-red loose earth 15 feet ; white sea or beach sand, 6 feet ; small grey sand with fine mica in about equal proportions, with detached lumps of tough blood-red ochraceous clay, 40 feet, making ninety-one feet in the whole. At the depth of 30 feet, and on the upper surface of the stratum of dark-red loose earth, lay the shells of clams, oysters and scollops. These animal remains were all broken. In this region they are almost always found in fragments. They seldom occur entire. Specimens of the two former were in the possession of the proprietors, and shewed to me : so that there was no deception. Fragments were found occasionally through the whole stratum. A piece of wood was also found, fifty feet down. It was soft, rotten, and decayed. Its ligneous character was perfectly distinguishable, and it seemed to be part of a larger parcel.

2. *Jamaica in Queen's County.*—About a mile south of the ridge of hills, on the land of Mr. Napier, on the turnpike road, about three miles west of the village, during that same season, about twenty-five feet below the surface, several pieces of wood were found in digging a well. They were decayed so far as to be soft, but the organization and structure of wood were evident to every observer. There were no animal relics here.

3. *New Utrecht in King's County.*—This season also, a well was dug, exactly on the ridge of hills, near the Narrows. Clam and oyster-shells were found scattered through the strata in going down ; and at the depth of sixty seven feet, below the surface of the ground, a shell of the large murex, or large periwinkle of our shores, was discovered, lying very little damaged, just above the water-line.

4. *New Utrecht again*.—Within the fort belonging to the United States, a little to the southward of Denyse's farm on the margin of the Narrows, a well was dug for the accommodation of the garrison. It is fifty-two feet deep. Thirty feet down, the diggers discovered fragments of clam and oyster-shells. And these were occasionally found all the way to the bottom. Through the whole course of the perforation, the earth was of a reddish colour and so hard and compact as to require the pick-axe to loosen it; except a thin stratum near the bottom, where the gravel was aggregated into a sort of rocky breccia, which was broken through by the force of a sledge-hammer. This fortification, it may be remarked, is on the westernmost extremity of the spine of the island as it slopes away toward the Bay.

5. *Oysterbay in Queen's County*.—At Mr. Welsers, near Cold Spring, the body of a tree was found, more than fifty feet below the surface of the earth and so solid as to require cutting through with an axe. But this happened several years ago and the fact is well known in the neighbourhood.

These facts, in addition to the former, put the alluvial character of Long Island quite out of doubt. Being curious in their geological relation, and evincing the modern formation of the strata to which they belong, I beg you to give them place and perpetuity in your valuable Journal.

*New-York, October 16th, 1813.*

#### EMERALD.

This Mineral is by no means uncommon in the United States. It occurs in the primitive range, and particularly in Granite, in which it is imbedded. In the District of Maine it has been found remarkably clear and transparent, and in every respect resembling the *Siberian Beryl*, par-

ticularly that discovered at Topsham, by professor Cleaveland of Brunswick College, the crystals are well defined hexaedral prisms, and are often imbedded in the smoky quartz which abounds in the large grained granite : in some instances, in point of colour, it equals the finest Peruvian Emerald.

At Chesterfield in Massachusetts it occurs in great abundance. Dr. J. F. Waterhouse who has carefully examined this locality, informs us that crystals, in hexangular prisms, from an ounce and under to 6lbs. in weight are found singly disseminated through the granite. They are of various dimensions, from a small size to that of a foot in diameter, their colour light green. The Chesterfield Emerald greatly resembles that lately discovered in France. If the new earth *Glucine* should be required for the arts or manufactures, this Emerald would furnish it in abundance ; as such is the quantity occurring at this place that Dr. Waterhouse obtained upwards of 70lbs. within a very small space. The Emerald occurs in other parts of Massachusetts. To the politeness of Dr. David Hunt we are indebted for several specimens found by that indefatigable mineralogist, in the vicinity of Northampton and Goshen.

At Haddam in Connecticut this mineral occurs in abundance, the crystals are from a very small size to several inches in length ; they are generally of a light yellowish green and sometimes of an amber colour resembling Topaz. Colonel Gibbs has in his possession a crystal of a deep green an inch in diameter and several in length, it bears a strong resemblance to the peruvian Emerald. Mr. Mather, a young mineralogist of great promise, discovered one seven inches in length by nine inches in the diagonal diameter, it is in the cabinet of Professor Silliman.

New-York affords but few instances of the production of the Emerald. It now and then, though rarely, occurs in the

granite veins which traverse the gneiss on the Island, about four miles from the city.

The Emerald is found in the vicinity of Philadelphia and at Chester. These are the principal localities of this mineral in the United States which have as yet come to our knowledge. As others occur, we shall with pleasure notice them.

#### MINERALS FROM TENNESSEE.

Among some Mineral Specimens we have received from Dr. Thomas I. Wray of Augusta, Georgia, are several valuable Sulphates, respecting which, he has favoured us with the following information.

“ They were taken from a cave in Cumberland mountain, Warren County, west Tennessee.

No. 1 is native Copperas, *Sulphate of Iron*, and No. 2. native plume Alum ore, *Sulphate of Alumine*. I have been credibly informed, that they are found in immense strata ; pervading a considerable extent of country, and can be dug in any imaginable quantity. In some places the Sulphate of Alumine predominates for a considerable distance, and is then found gradually passing into Sulphate of Iron. And in other places beds of Pyrites commence, and at length loses the Iron in the aluminous principle : occasionally large quantities of either are discovered in a state of much greater purity than the accompanying specimens, and then it is dug by the owner or discoverer (for much of it lies in unlocated land) and sold to be applied to the arts without undergoing any refining process. These beds of pure native Copperas or pure native Alum are always either in natural caves or under the brow of a bluff, where they are sheltered from the influence of heavy rains or torrents of water.

The specimens I herewith present you, were taken from

the very cave where some time ago were found two human frames (a male and a female) which were carefully wrapped up in a curious fabric constructed principally of feathers, and the whole enfolded in dressed deer skins ; an accurate account of which was published in several newspapers and some of our scientific repositories.

When first discovered they were in a state of perfect preservation, as regards their forms and structure, but in substance, hard, compact, earthy, capable of being broken with the hand. The fracture perfectly earthy, but accurately presenting to view the appearance of muscular fibre, the vascular and ossific parts. Unfortunately they were found by illiterate labourers, who set no value whatever on their discovery, and who allowed every visitor that wished it, to break off parts either to be totally destroyed on the spot, or taken away.

#### WHITE PYROXENE.

A mineral, presenting some characters which rendered its nature doubtful, we some time ago transmitted to Paris, for the examination of our venerable friend M. Haüy, who, after duly considering its structure agreeably to the laws of crystallization, has pronounced it to be *Pyroxene*. This substance is white, and occurs crystallized in eight-sided prisms, of which two opposite sides are often much larger than the other six, so as to present a tabulated form. The prism is variously terminated, sometimes resembling the Pyroxene of Vesuvius, while in other instances the termination is more complex, giving rise to a new variety, which M. Haüy has named *épiméride*.—Specific gravity 3. 1. Crystals of various sizes, from minute to several inches in length are found imbedded in the primitive

limestone which crosses the island of New-York at its northern extremity.

#### NATIVE BISMUTH.

We are informed by Professor Silliman, that this metal has lately been discovered in the town of Huntington, parish of New Stratford in the state of Connecticut. It is interspersed through a vein of quartz, in brilliant plates; the largest generally not more than an inch in diameter, its surface is sometimes beautifully reticulated. In the same vein are common and magnetic pyrites, galena and other substances indicating a metallic deposit. As yet, the Bismuth is found only in a few spots in the vein, and it is uncertain whether it can be obtained in quantity, the vein however has been but little explored.

#### ELASTIC MARBLE.

*Extract of a letter from William Meade, M. D. to the Editor.*

“ I informed you sometime ago of a discovery I made of Elastic Marble; since that period, I have obtained some fine specimens, and have ascertained to a certainty, that so far from its elasticity being caused by the loss of its water of crystallization as asserted by Fluvean de Belvue and others, that it is (in this species at least,) precisely the reverse. An accident produced this discovery. I had procured a piece of this marble two feet long and one inch thick, which I was induced from its fine grain and colour, to get polished. When this had been done, and the surface was dried near the fire, I was surprised to find, that it had totally lost its elasticity, and was inclined to attribute it to the change which may have taken place in the arrangement of its particles, by

the action of polishing. Unwilling however to lose so fine a specimen, it occurred to me to wet it with water, and I found its elasticity immediately restored. I have tried the same experiment on other specimens, and I can at any time deprive them of this property by heat, and restore it immediately by plunging them in water."

### PROPOSED CLASSIFICATION OF SOME OF THE ORES OF IRON.

The following which was intended as a note to Colonel Gibb's paper on the mass of Iron from Louisiana, we received after that part of our present number was printed off, we therefore now insert it as connected with that communication.

"I should be tempted to alter the nomenclature and classification of these substances, in the following manner.

#### Genus. IRON.

##### 1st. *Species.* Native Iron.

- 1st. *Subspecies.* *The varieties of native Iron containing Nickel* which might retain its common name.
- 2nd. *Subspecies.* *Native oxydulous Iron* which is the *Magnetic Iron* of Werner and *Fer oxydulè* of Haüy.
- 3d. *Subspecies.* *Native oxydulous chromiferous Iron* which is the second subspecies, containing also oxyd of chrome according to Messrs. Silliman and Gilmor.

**MINERALOGICAL PREMIUMS.**

We feel peculiarly gratified in noticing every effort towards increasing mineralogical knowledge, and in our opinion there is nothing which contributes more towards the accomplishment of this object, than the adjudging to such as are proficient in the science, rewards commensurate with their attainments, and it is therefore with no ordinary degree of pleasure that we announce the following distribution of premiums, offered by Colonel Gibbs and Professor Silliman.

Colonel Gibbs' premium consists of one hundred specimens to be taken from the duplicates in his collection, this premium to continue for five years and to be adjudged to such member of the senior division of the Mineralogical Class in Yale College as his companions of the same division designate by more than one half of the whole number of their votes ; the choice is founded upon superiority of attainments in mineralogical knowledge, and upon services rendered to the science by useful discoveries and observations.

1811.

Colonel Gibbs' premium was adjudged to Mr. Solomon Baldwin of Brookfield, Connecticut.

During his attendance on the Lectures, he discovered the beautiful green marble which he is now working in the vicinity of New-Haven.

1812.

This Premium was adjudged to Mr. Elijah Baldwin, Milford, Connecticut.

As a further encouragement to the study of mineralogy, Professor Silliman has added a second premium to the senior and junior divisions of the class. It is a copy of this

Journal for five years from its commencement. To the junior division of the class, he offers as a premium, a free ticket to his future courses of lectures on mineralogy.

These Premiums were adjudged in 1812.—The second Premium in the senior class to Mr. George Bliss of Springfield, Massachusetts.—The first in the junior class to Mr. Elias Cornelius of Somers, New-York.—The second in the same class to Mr. Hiram F. Mather of Haddam, Connecticut.

1813.

*Senior Class.*

1st. *Premium.* 100 specimens of foreign Minerals, given by Colonel Gibbs,—adjudged to Mr. Hiram F. Mather, Haddam, Connecticut.

2nd. A copy of the American Mineralogical Journal, for five years from its commencement,—adjudged to Mr. Elias Cornelius of Somers, New-York.

*Junior Class.*

1st. *Premium.* The same,—adjudged to Mr. Joseph H. Dalles, of Charleston, South Carolina.

2nd. A free ticket of the Mineralogical lectures,—adjudged to Mr. Theodore Dwight, Jr. of Hartford, Connecticut.

KIRWAN.

It is with sincere regret we announce the death of this great man, to whom Ireland in particular, and the world in general, owe so much. He may justly be considered as having contributed more during the age in which he lived, than any other individual towards promoting mineralogical science in Great Britain.

We trust we shall, ere long, receive from the hands of some able biographer, a detailed account of the labours of this most useful member of society.

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